THE MODEL ENGINEER

Vol. 102 No. 2537 THURSDAY JAN 5 1950 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

5TH JANUARY 1950 — VOL. 102 NO. 2537

SMOKE RINGS

Thank You

● OUR EDITORIAL desks, at the moment, are decorated with many Christmas cards conveying good wishes from known and unknown readers in many parts of the world, as well as in this country. We would like the senders, whether they are in Africa, Australia, New Zealand, Canada, Norway, Sweden, Denmark, Germany, France or Britain, to know that their sentiments are very much appreciated and most heartily reciprocated. This kind of thing has a decidedly tonic effect on us.

Our Cover Picture

● THE " CASTLE " class of locomotives, first introduced as long ago as 1924 on the Great Western Railway, to the designs of Mr. C. B. Collett, must rank amongst the most remarkable locomotives ever built. In less than six months after the first one had been completed, their success had been firmly established; moreover, in a systematic test, the results of which were first published in March, 1925, the technical data obtained astonished the locomotive profession by reason of the outstanding efficiency which was revealed.

Since that time, the engines have, first, established a reputation for prodigies of speed and haulage; secondly, by their outstanding performance, set a standard of general efficiency which others have striven to emulate, and thirdly, created a record in that the design has been very little altered during a period of twenty-five years and that engines of this class are still on the building programme. In this way, the design has confounded its many critics who find themselves hard put to it to justify their criticisms.

It would be more than interesting if a perfect scale model of a " Castle " could be built for 5-in. gauge, or larger, and tested systematically against any other type of express passenger engine on the same gauge, just to see what difference, if any, there would be in the general performance of the two engines. For, the most striking feature of the " Castle " is that it is by no means a large engine, judged by modern ideas; yet it seems capable of holding its own against larger engines, as has been demonstrated more than once. There would seem to be little reason to suspect that a miniature " Castle," properly built, would not show to some advantage over a bigger engine for the same duties. The " Castle," because of her four cylinders and tapered boiler barrel, might be somewhat complicated and costly to build; but, as our cover picture shows, she is pleasingly impressive in appearance, especially when fitted with the later and shorter chimney seen in our picture.

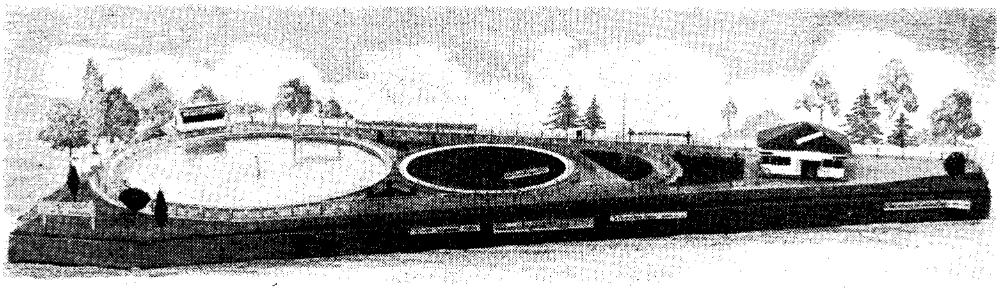
What of maintenance? We believe that the full-size " Castles," before the war, were averaging something like 160,000 miles between heavy repairs, and this is a high figure for engines employed on such onerous duties; and it suggests that a miniature " Castle," with the right kind of workmanship in her, would not be heavy on maintenance. Further, she would be an ideal engine for heavy haulage at high speed on an extended track.

Our cover picture shows B.R. (Western Region) No. 5042, *Winchester Castle*, on the 1.30 p.m. West of England express at speed near Ruscombe, Berks.

An Australian Project

● WE HAVE received an interesting letter from Mr. V. H. Messer, hon. secretary of the South Australian Society of Model Engineers, who writes :—

" Just a little news of doings ' down under ' in South Australia. The S.A. Society of Model Engineers now has branches at Mt. Gambier and Whyalla and a membership of more than 130.



" Enclosed is a photograph of a model of the model engineering park being constructed at Nullswood about three miles from Adelaide.

" The land ($\frac{3}{4}$ acre) is State Railway property and is leased to the society at a very low rental. It is located at the junction of the Interstate line to Melbourne and a country line with terminus at Willunga.

" Up to date much progress has been made ; members, by voluntary labour have built a clubhouse 36 ft. × 16 ft., which is well furnished with second-hand theatre seats, canteen, etc. A circular boat pond (25 laps = 1 mile) has been excavated and is ready for cementing, 528 ft. of multigauge track and necessary concrete piers are now in course of erection, and included in the project is a miniature speed car track, 25 laps to the mile. All this has taken a long time owing to shortages of material. We feel quite proud in the fact that all our meetings are held in *our own* clubhouse.

" The society will give a very hearty welcome to any model engineers who decide to settle in South Australia—if they will get in touch with me, as secretary, when they arrive. THE MODEL ENGINEER describing the Exhibition just arrived and reminded me of the first ' M.E.' Exhibition many moons ago. I left London in 1908, 41 years ago, and still hope to visit England before I get *too* old.

"After reading Mr. Turpin's article on binding THE MODEL ENGINEER (May 19th, 1949), I successfully bound my 1903 issues of 'Ours'! This was quite a pleasant change after working in metal."

He ends with greetings to all kindred societies, and we have no doubt they are most cordially, if somewhat enviously, perhaps [!], reciprocated.

Bradford S.M.E.E. New Secretary

● WE LEARN that, owing to pressure of business, Mr. W. Wood has resigned his position as hon. secretary of the City of Bradford Society of Model and Experimental Engineers. His place has been taken by Mr. E. Hammond, 83, Norman Avenue, Eccleshill, Bradford, to whom we extend our good wishes for a successful term of office.

"Doncaster Can Engineer It"

● THE EXHIBITION sub-committee of the Doncaster Engineering Society report that "Doncaster Can Engineer It," an exhibition of engineering products made in Doncaster, will take place in the Technical College from February 4th to the 11th, 1950. The exhibition will be open until 9 o'clock each evening. In addition to showing actual manufactures, firms will exhibit machines in motion and there will be a series of film shows.

12,000 people saw the exhibition two years ago and it is hopefully estimated that the greater interest of many of the exhibits this year will ensure a still greater attendance of the general public. Arrangements will be made for organised visits of children of school-leaving age, to give them a foretaste of the opportunities there are in engineering in Doncaster.

Well-known firms who have already booked space include Auto Components Ltd., British Bemberg Ltd., British Railways Executive, British Ropes Ltd., F. J. Arrand & Sons, Cementation Co. Ltd., Crompton Parkinson Ltd., International Harvester Co. Ltd., E. W. Jackson & Son Ltd., Kenneth Thelwall Ltd., Pearson & Sons Ltd., Pilkington Bros. Ltd., Peglers Ltd.

Address Wanted

● WOULD THE reader who wrote to us on December 10th, from Truro, and signed his letter "Brunel," please send us his full name and postal address ? We do not normally take any notice of anonymous letters ; but "Brunel" raises a number of questions we would like to reply to, if he will give us the means of doing so.

The "M.E." Index

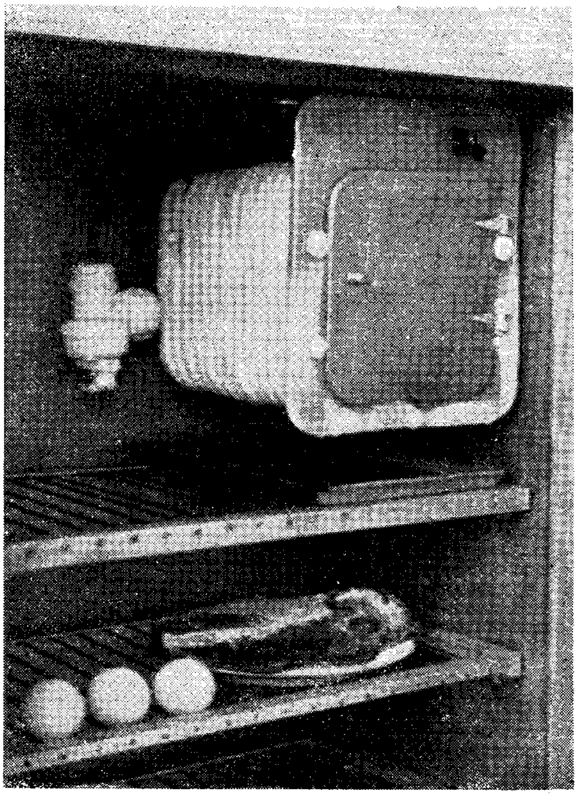
● ANOTHER VOLUME of THE MODEL ENGINEER has now been completed and we repeat our offer to supply subscribers and regular readers with the index for Volume 101, if they will send us a stamped addressed envelope (1d.) of sufficient size to take a copy of the journal flat. The index will not be printed until we know how many copies are required to fill the demand, but readers are requested to make early application to the Sales Manager, THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

*A Domestic Refrigerator

by L. C. Sherrell

THE tinsmiths come into their own at this stage, with the inner cabinet, Fig. 13, and I have no doubt will find it simplicity. The others, however, need have no qualms about tackling it, as it can be made quite easily on the kitchen table. Twenty-gauge aluminium sheet is ideal for the job, but please do not paint it.

**Continued from page* 807, *Vol.* 101, "*M.E.*," *December* 22, 1949.



Ready for "defrosting"

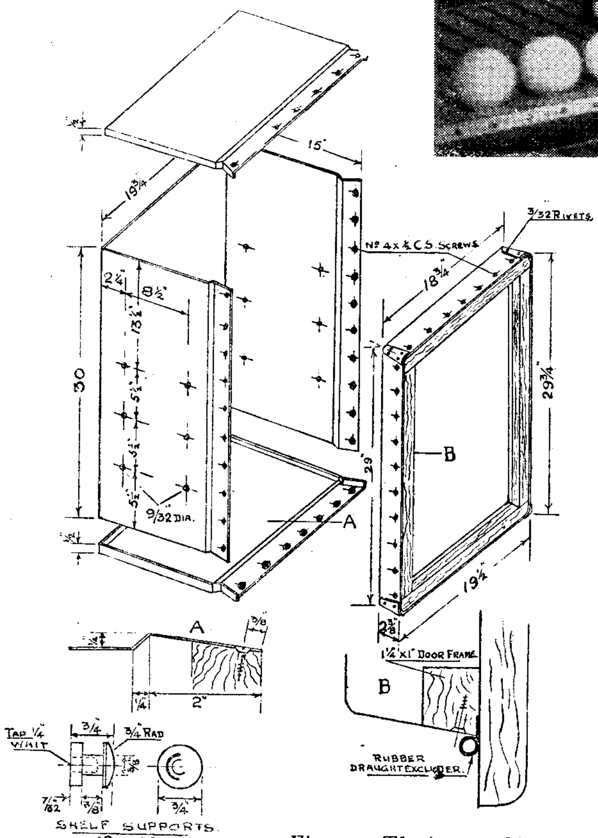


Fig. 13. *The inner cabinet*

It will be noticed that the opening of the cabinet is stepped in a $\frac{1}{4}$ in. and then flared out to its original size on all four sides. Now if one corner is first cut out in cardboard and experimented with so that the top or bottom will marry up with the sides and give the correct flare, the job is half done.

You can go right ahead and mark out the sheet. Flare each end of the case first, clamping between two pieces of 2-in. × 2-in. timber having clean edges and beat over to about 45 deg. with a wooden mallet; this will toughen the metal and stop it straightening out when bent back the other way. The rest is quite straightforward, the top and bottom being riveted in with 3/32-in. aluminium rivets at 2 in. intervals.

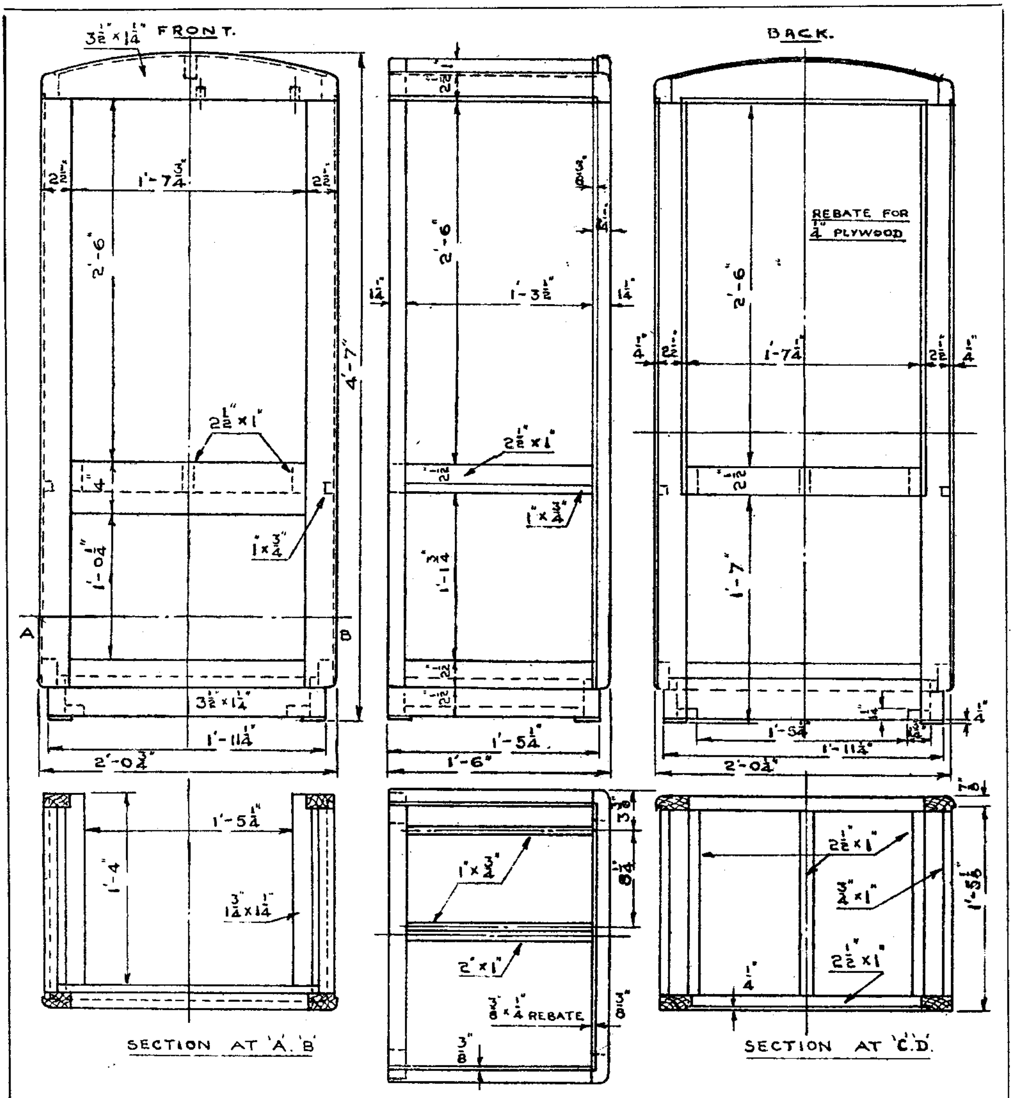


Fig. 14. *The outer cabinet*

The Outer Cabinet. Fig. 14

At this stage the micrometers and lathe make way for the plane and mortise machine. If joinery is your weak point, I advise you to get the framework made by a professional "chippy." Don't forget that the back will be ½ in. less in width than the front; it is quite easy to slip up here.

The top rails and front are mitred so as to show no end grain. The ply panels are glued in and pinned. The front uprights may have to be bevelled slightly when fitting the inner cabinet to allow the flared-out part to lay snugly against them. If this inner cabinet sits nicely on the 2½-in. × 1-in. crossbearers, the only fixings needed are the ½-in. No. 4 c.s. brass screws around the opening, the heads of which are fluxed and hot dipped. The insulation at the bottom is packed in before finally fitting the inner cabinet; make a good job of this, it is the part that gets the most heat. The sides can be packed after the ply is fixed.

Door and Flap. Fig. 15

No doubt a good piece of 7-ply would be the job here; I had to tongue and groove 1-in. prepared boards. But whatever is used, it should be quite flat and not rock when laid over its aperture. When finally hung, it should be tested to see that it is leakproof by opening and

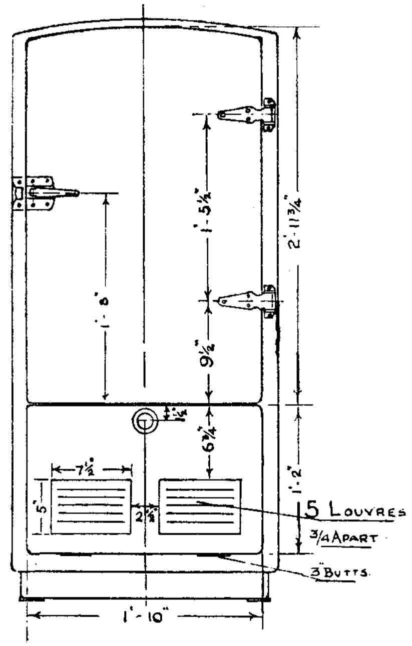
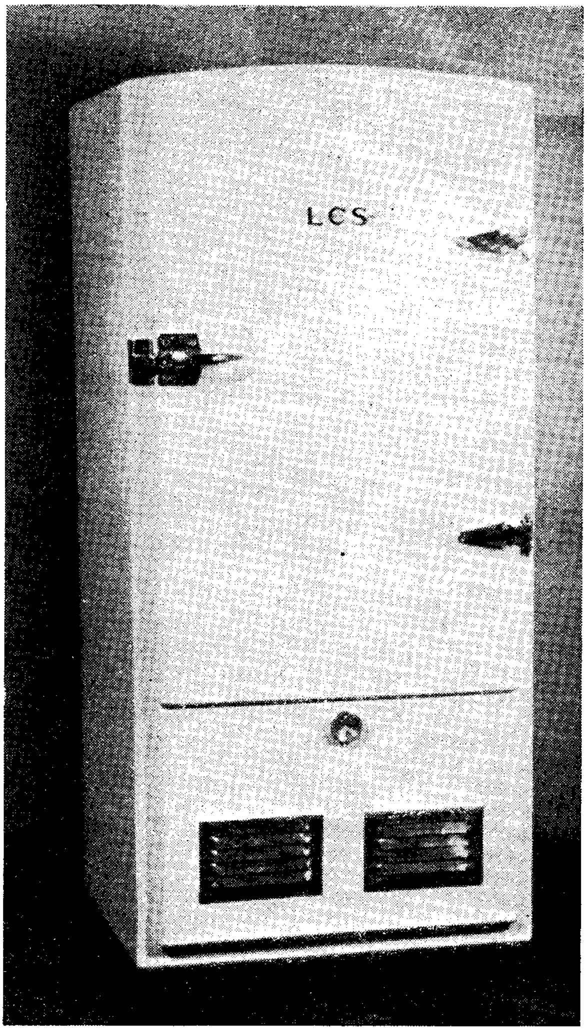


Fig. 15. *Door and flap*



The completed refrigerator

closing on to a piece of paper every few inches, all the way round. If it grips the paper, O.K. ; if not, you can pack behind the rubber draught-excluder with strips of cardboard until it does. See Fig. 16 for suitable hinges.

On a hot summer's day, the temperature of the bottom compartment can become really hot and requires all the ventilation it can get. It will be seen that I have placed two louvres in the flap to enable the hot air from the cooler

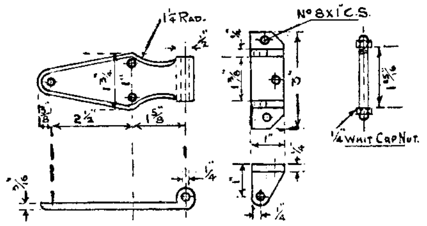


Fig. 16. *Details of hinge*

to be exhausted with the least resistance, and so with the back left open it provides good air circulation. They are simply made like a tin lid in 20-gauge aluminium, and the lines scored right through with a sharp-pointed knife. They can, more or less, be pressed out to the right shape with the fingers.

The 2 in. diameter knurled aluminium knob is fitted with a spindle having a square at the end to take a catch that fits into a suitable groove made on the underside of the 4-in. × $1\frac{1}{4}$-in. runner.

The painting programme can now commence. All knots are liberally covered with knotting. Three coats of good quality flat white lead paint, rubbed down between each coat, are followed by a coat of "Ripolin" bath enamel, allowed three days to dry and then given one more coat. I think you will be satisfied with the result.

(*To be continued*)

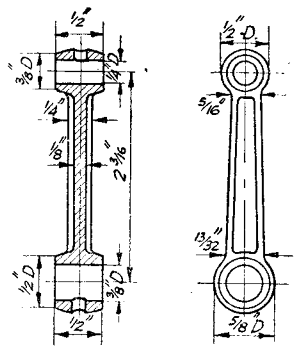
PETROL ENGINE TOPICS

*A General-Purpose 15-c.c. Two-Stroke

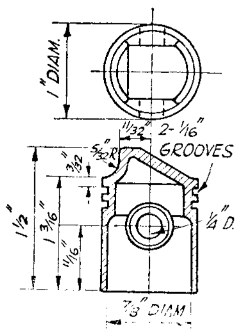
An Elementary Exercise in Model Petrol Engine Construction

by Edgar T. Westbury

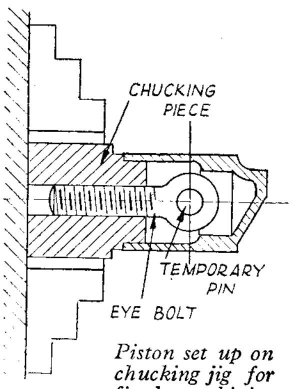
If the crankshaft has been accurately machined, by the methods which have been described, it will be possible to assemble it with the two main journals in exact alignment, so that it runs quite freely in the two main bearing bushes when the crankcase is assembled. This was actually the case in the engine built by Mr. Message, and if it should be found that any "faking" is necessary to get the shafts lined up, it indicates that something must have gone wrong in the application of the method. Apart from movement of the angle-plate on the faceplate between operations, the most likely eventualities are lack of uniformity in the size, or errors in parallelism, in the roughed-down journals prior to clamping, or the presence of dirt or swarf in the bore of the clamp plates. Before final assembly of the crankshaft, it is, of course, necessary to fit the connecting-rod, so the machining of this part may be put in hand next.



Connecting-rod (1 *off*, *bronze*)



Piston (1 *off*, *cast-iron*)



Piston set up on chucking jig for final machining

Connecting-Rod

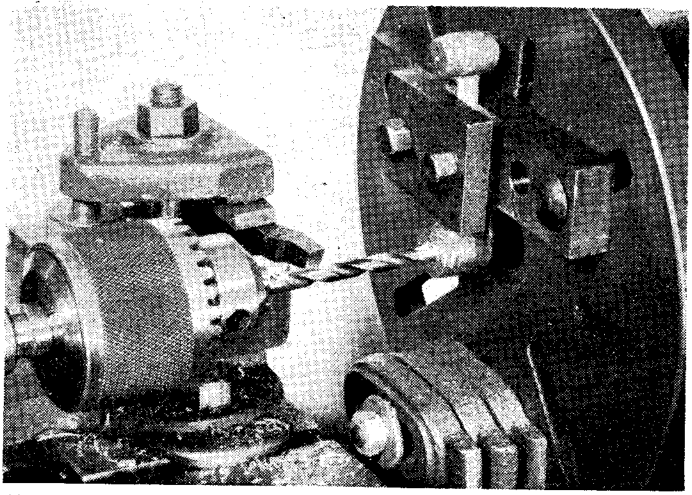
For an engine of moderate speed and performance, a cast bronze connecting-rod has been found to give satisfactory results; but if very high speed—in the region of 10,000 r.p.m. or more—is required, a lighter rod, machined from solid duralumin (or similar high-tensile light alloy) will be preferable. The procedure for making rods from the solid has been described in The Model Engineer on several occasions, and with a choice of several methods, I usually prefer to rough out the general shape of the rod by turning it between centres, the shank being tapered and the ends turned spherical, prior to flattening the sides and boring the eyes.

The cast rod, however, only requires the eyes to be bored and faced so as to be parallel with each other both ways, and I have described in the past how this condition can be ensured by clamping the flat shank of the rod to a plate or bar which can be shifted on the faceplate to centralise each eye in turn. This is the method which was employed by Mr. Message, and is illustrated in the photograph reproduced here. It is advisable to check up the distance between the eye centres, as castings cannot always be relied upon for dimensional accuracy, and mark this by centre-punching the bosses, setting them up so that the punch dots run true in each case. When clamping the rod to the bar, make certain that the side centre-line of the rod is parallel with the faceplate, using packing if necessary to correct any errors. A similar set-up may be used when the rod is machined from the solid, if the sides of the rod are first milled or filed flat and parallel.

Centre-drill the bosses and use a small pilot drill (not larger than $\frac{3}{16}$ in.) to begin with, afterwards opening up to within 1/32 in. of finished size, then boring and reaming. Avoid excessive end pressure on the drill which might possibly spring the rod out of truth. The end face of the boss is faced at the same setting, and if desired, a cut can also be taken over the outside of the boss to clean it up and correct any eccentricity, as far as the shank of the rod will allow.

*Continued from page 797, Vol. 101, "M.E.," December 22, 1949.

It will, of course, be necessary to set the top slide over to an angle of about 15 deg. for this operation. After boring both eyes, the reverse face and outside of boss can be dealt with by mounting the eyes on pin-mandrels of appropriate size. The width of the big-end eye should be just sufficient to allow it to work freely on the crankpin, without end play, and the shank of the rod should be central. Width is not critical at the little-end, as a good deal of end play is allowed, and it is only necessary to ensure that the eye will be fairly central in the piston and cannot possibly bind against the gudgeon-pin boss on either side.



The connecting-rod, clamped to a flat bar mounted on the faceplate, being drilled at the big-end eye

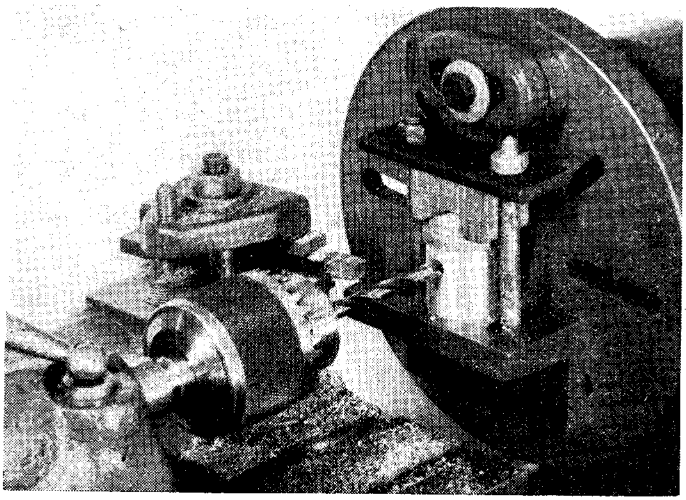
The outside contour of the rod may need to be filed, especially around the end bosses, to fair them up with the machined surfaces. No work should be necessary on the fluting of the sides of the cast rod unless it is desired to improve their appearance; but if the rod is made from the solid, the flutes will, of course, have to be milled. Lubrication holes must be drilled in the ends of the bosses to admit oil mist to the bearings at the point of lowest pressure in each case.

Piston

A casting is employed for this component, which may be either in iron or aluminium alloy, according to the kind of duty for which the engine is intended. If the working speed of the engine is not required to exceed three or four thousand r.p.m., I strongly recommend a cast-iron piston, which can be fitted to a very fine clearance, and will reduce friction, not to mention wear and tear. It is even possible to dispense with piston rings in this case, though they are very helpful in an engine of this size; but if it is decided to dispense with them, omit the ring grooves also, or they will provide a leakage path from the transfer to the exhaust ports.

The procedure for machining the piston is as follows: First hold the casting in the four-jaw chuck with the open end outwards, leaving as much of the length projecting as possible, up to well above the gudgeon-pin centre in any case. Set it up so that the *inside* surface runs truly, using a bent scriber in the toolpost or scribing-block to check up on the part beyond the internal bosses. Face the end, and clean up the inside of the skirt, as far as the bosses will allow, with a stiff boring tool; then machine the outside as far as it is accessible, to within about 1/32 in. of the finished size, leaving the surface smooth and parallel.

Before removing the casting from the chuck, scribe a centre-line through the centres of the internal bosses with the aid of a scribing block, having the scriber point set exactly to lathe centre height, and produce the line on the outside of the piston on both sides of the diameter. The height of the gudgeon-pin centres from the bottom face of the piston should also be marked and the intersection centre-punched to indicate the position of the gudgeon-pin centre.



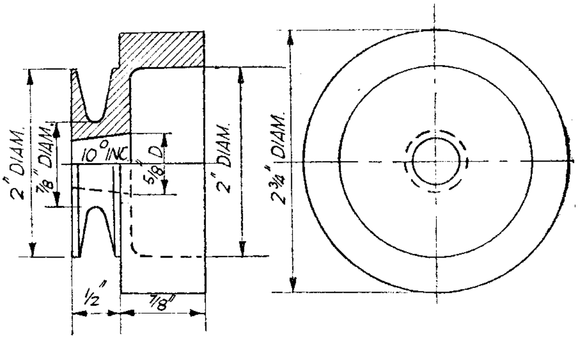
The piston, after the primary machining operation, set up on an angle-plate for drilling the gudgeon-pin hole

For boring the gudgeon-pin hole, the piston should be set up on an angle-plate with the centre punch mark running dead truly. There is a pitfall here which many constructors fall into very easily: that is, the possibility that, although the mark on the front of the piston may be set to run truly, the invisible one at the back is not necessarily so; in other words, the piston may be set slightly askew so that the hole, if bored in this position, would not be truly on the diametral centre-line of the piston. This, in itself, would not matter so very much—in fact, some engines have been made with the gudgeon-pin deliberately asymmetrical, with a view to keeping the tilting thrust always in one direction so as to eliminate piston slap, or that annoying affliction "two-stroke rattle"—but in this case it would cause the rear boss to be drilled out of centre and put the piston deflector out of square with the gudgeon-pin.

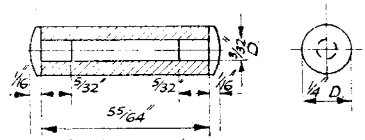
The error can, however, be positively prevented by care in locating the piston on the angle-plate before it is bolted to the faceplate. Scribe a line squarely across the centre of the angle-plate from front to back, making it as distinct and definite as possible, so that it can be clearly seen when locating the piston in position; in this way the axial centre-line can be set to coincide with it both at the front and back. Unless one's eyesight is very acute, the use of a lens to ensure exact location is recommended. The piston is held down by a strap and two bolts, with a piece of hardwood packing, shaped to fit over the deflector, interposed between; this set-up is clearly shown in the photograph. Shift the entire angle-plate assembly to set the marked gudgeon-pin centre exactly central.

Use a centre-drill to start the hole, entering it fairly deeply so that the pilot drill (about $\frac{3}{16}$ in.) will enter up to its full diameter and thereby receive adequate guidance. After drilling through the front boss, put in a slightly larger drill—a No. 12, say—which will tend to bind rather tightly in the hole, and thereby be prevented wandering when it encounters the rear boss. Drill right through the latter, then open up to the nearest possible size under ¼ in., and finish with and old and blunt reamer if available, so that it will tend to cut slightly undersize.

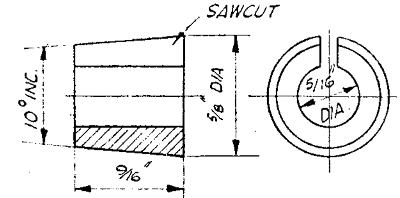
The outside of the piston may now be finished, and the method recommended will enable this to be done without the slightest risk of distorting the thin wall of the casting, such as would be caused by any of the common methods of chucking or spigot mounting. First hold a short piece of round material, 1 in. diameter or over, firmly in the chuck, face the end, and turn a spigot to take the skirt of the piston a neat but not tight push fit. At the same setting, drill and tap a centre hole, preferably fine thread, and not less than ¼ in. diameter. Do not remove this piece from the chuck, but make or obtain a simple eye-bolt to fit the centre hole; a piece of ½ in. × ¼ in. flat bar, turned down and screwed at one end, and then cross-drilled ¼ in. diameter, will serve the purpose. Cut a piece of ¼ in. steel bar about ⅞ in. long to serve as a dummy gudgeon-pin, screw the eye-bolt in the chucking-piece, and fit the piston on the spigot, then pass the pin through the gudgeon-pin holes and the eye of the bolt, and turn the piston round till it is drawn up firmly against the shoulder of the spigot. The outside surface can now be finished to size, using a ring lap to take off the last "thou." or so, and fitting to minimum possible clearance, if an iron piston is used; but, for an aluminium piston, a clearance of not less than 0.002 in. at the skirt, increasing to about 0.005 in. at the top land, should be allowed. The ring grooves may also be turned at this setting, taking great care in the fit and finish of the sides of the grooves, and making them about 0.005 in. deeper than the thickness of the ring. Use the finished ring as a gauge, presenting it to the groove reverse way on, and when in position, lay a rule along the side of the piston to make sure there is "daylight" between the ring and the rule, to indicate ample clearance. Unless this is assured, the ring may bind and seize up in the cylinder.



Flywheel (1 *off, cast-iron*)



Gudgeon-pin (1 *off*)



Collet (1 *off, mild-steel*)

The turning jig can be used to hold the piston in the vice for filing and polishing the top of the head, which should be as clean and smooth as possible, with all corners nicely rounded off. Make sure that the sides of the deflector have plenty of clearance in the cylinder, and also in the radius of the head when at top dead centre. The cut-off edges should be at the same height both at the transfer and exhaust sides of the deflector.

(*Continued on page* 13)

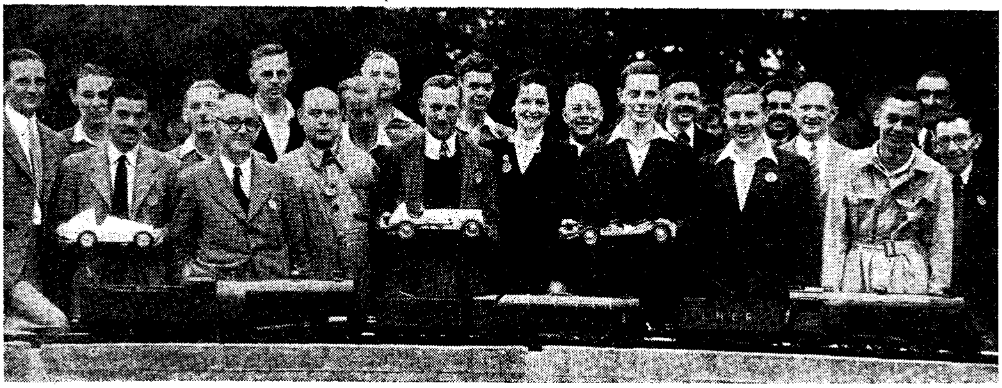


Photo by courtesy] [" *Lincolnshire Echo* "

Owners and starters

A Lincoln "Double"

THE grand opening of the Lincoln Society's multi-gauge track and miniature car track in Boultham Park, was a recent " double event " of importance ; by 2.30 p.m., which was fixed for the opening ceremony, quite a large crowd had collected.

Mr. J. Rodway, M.I.Mech.E., introduced Alderman Doughty, chairman of the Lincoln Parks Committee, who performed the opening ceremony.

In his opening speech, Alderman Doughty praised the society for their finely-constructed tracks and for the amount of hard work which they had put in to see them to a successful conclusion, and, last but not least, for turning one of the most degenerate corners of the Boultham Park into one of the most lively.

Alderman Doughty then cut the tape spanning the rail track and allowed Mr. G. Dyer, driving " Bantam Cock " and Mr. D. Yarnell, driving " Maisie " to complete several fast laps.

Mr. R. H. R. Garraway, president of the society, replying to Alderman Doughty's speech, gave the society's most grateful thanks to the Parks Committee for all the help they had rendered in the past, and said how much the society appreciated the use of the ground within the precincts of the park.

At the end of all the speechmaking, Alderman Doughty, Mr. R. H. R. Garraway and Mr. J.

(*Continued on page* 20)

Photo by courtesy] [" *Lincolnshire Echo* "

" *Bantam Cock,*" *driven by Mr. G. Dyer, carrying top weight*

*TWIN SISTERS

by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally, but very different internally

NOW we come to the rear system of springing, which comprises two coil springs and an equaliser beam, running underneath the axlebox. The ends of the beams are drilled as shown on the drawing, but it would be as well to make sure that the two holes drilled in the horn-cheeks, to take the spring rods and forks, do in fact coincide with the holes in the beam, regarding their working centres. The best way is to check each horn-cheek separately, taking the centre of the beam attachment bracket, or rather, the hole in it, and the dimension from there to each horn-cheek hole, so that the beam may be drilled exactly in accordance with it. This will ensure the beam and rods standing quite vertically and the rods sliding up in the guide holes in the horns without binding.

The beams are now available in casting form, and are in gunmetal, but there is no reason why these should not be fabricated if the builder is generally not in favour of castings. The sunk "panels" in the beam could be milled out with an end-mill, and these are on both sides of the beam. Even if this feature is for ornament only, I am much in favour of it being reproduced, as the beam may be seen quite clearly between the spokes of the trailing wheels, and solid beams might tend to look clumsy.

The centre hole in the beam is counter-bored to give the hinge-pin a flush fitting, and the point to watch here is that the pin must be capable of being tightened up on its bracket, and with a lock-nut at the back without clamping the beam to prevent quite free movement. The counter-bore in the beam could be machined with a normal spot-facing cutter, made from silver-steel, and having a ¼-in diameter pilot. It will be seen from the drawing that mention is made of a small "Allen" screw head, silver-soldered into the head of the hinge-pin. This is to provide means for holding the head against turning whilst tightening the lock-nut behind the bracket, and it gives also some means of putting it in position in the first place.

I agree that this is not the only method of doing the job, and the head of a normal cheese-head screw would do equally as well. The point is that the head must be quite flush, and the "Allen" screw lends itself very well to this class of treatment. The point to remember is that when the head of the pin is drilled to take the head of the screw, the latter should be slightly proud of the face of the hinge-pin head, and not too tight in it. Clean the sides of the screw-head only, leaving the natural blue-black finished top face; this will prevent the silver-solder taking and running over into the inside hexagon, and so spoiling the job. After silver-soldering, the hinge-pin may be chucked, and the whole lot refaced to one flat head, and with very little loss of depth in the hexagon of the inserted screw-head.

I use this method of tightening flush-headed parts quite often, and the fixing of leading wheel coupling-rods on to their crankpins is one example. There is no doubt about it that it works and looks very well.

The rods and forks are simple jobs, and the forks are shown as machined parts. Again, I know of no reason why these should not emulate those used on the prototype, which are forged from the solid. The best way to achieve this is by making them from black strip steel, bent over a simple former, and then filed to the final outline. The rods should be turned from steel—stainless, for preference, in view of their inaccessability, and the general presence of steam and water. Whatever the material used, aim at a good smooth finish to allow the rods to slide freely.

After silver-soldering the rods into the forks, a die may be run down the threads once more, to clear away any traces of the solder that might bind the thread where the spring tensioner works, as it may be necessary to have this adjusting nut hard down on the top of the fork, for the slackest spring position.

The spring top caps are recessed to take a tiny felt washer. The exact size of this washer does not matter for its outside diameter, but it should fit the spring rod quite closely.

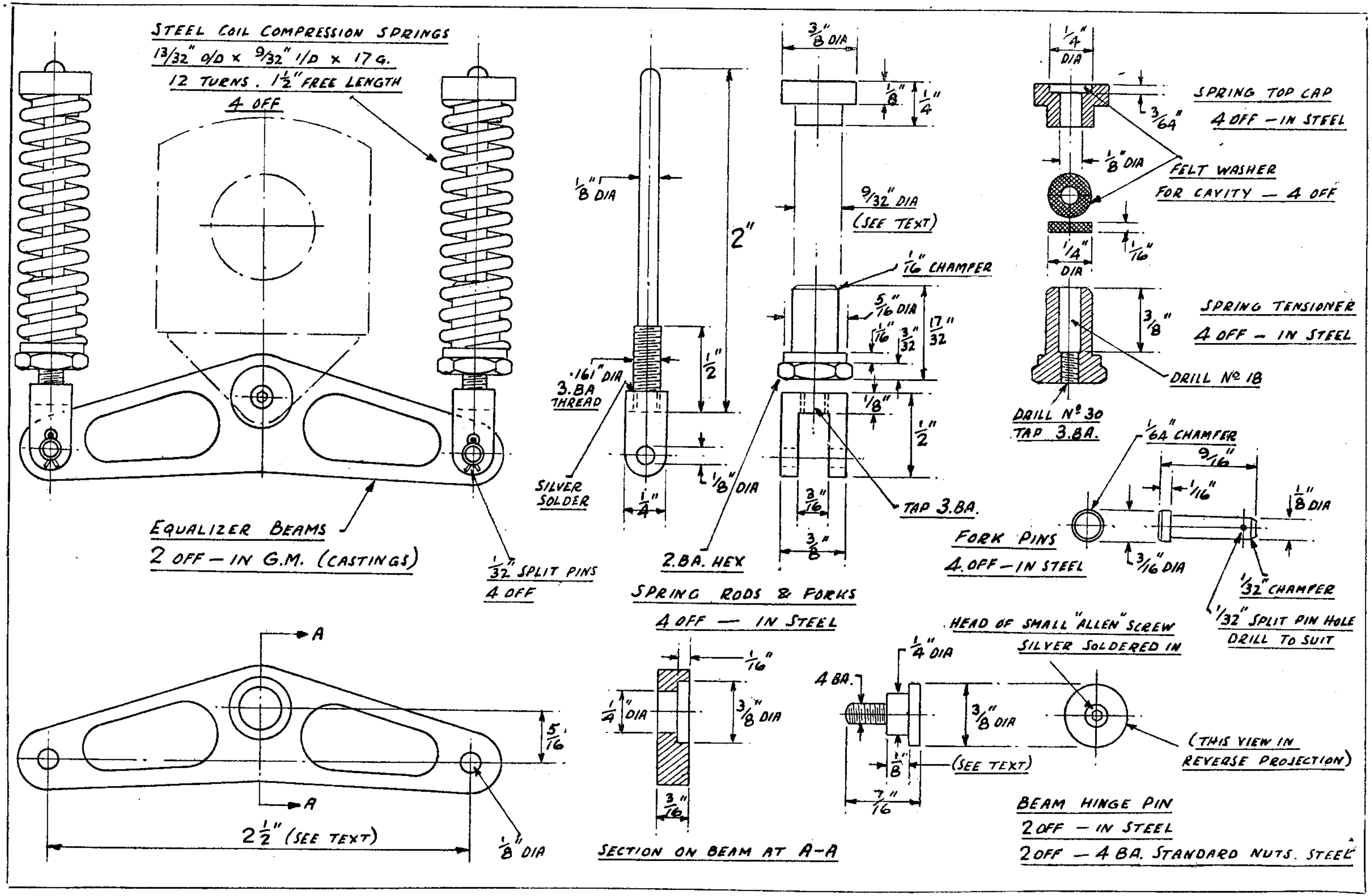
The recess on the top of the horn-cheek, provided for oiling purposes, will feed the rod, even if the hole in the horn is a bit slack, for the felt washer will prevent the oil being lost too quickly by running away down the rod.

On both the spring top cap and the spring adjusting nut, or spring tensioner, there is a diameter given as 9/32 in., which fits inside the coil spring ends. It would be as well to have the springs ready, and to turn the two parts to fit the spring. It would not matter if the top cap fitted tightly, but the adjuster should be free to rotate inside the spring. It will be noticed also that the adjuster has a No. 18 hole drilled down part of its length; this is to avoid having a needless length of hole to tap out, and in stainless-steel this is always a consideration.

Fork pins do not require a great deal of comment, although some model makers dislike diminutive split pins on the score of their somewhat "spiteful" ends, which have an annoying way of tearing the hands and the cleaning rags if one is not too wary.

For those so minded, it would be quite in order to use pins with turned shoulders to allow a small thread and nut type of fixing, and without fear of squashing the forks when really tightened up.

**Continued from page* 811, *Vol.* 101, "*M.E.*," *December* 22, 1949.


STEEL COIL COMPRESSION SPRINGS
13/32" O/D × 9/32" I/D × 17 G.
12 TURNS. 1½" FREE LENGTH
4 OFF
EQUALIZER BEAMS
2 OFF — IN G.M. (CASTINGS)
1/32" SPLIT PINS
4 OFF
1/8" DIA
2"
.161" DIA
3.BA
THREAD
1/2"
SILVER
SOLDER
1/4"
2.BA. HEX
3/8" DIA
1/8"
1/4"
9/32" DIA
(SEE TEXT)
1/16" CHAMFER
5/16" DIA
1/16"
3/32"
17/32
1/2"
3/16"
3/8"
TAP 3.BA.
SPRING RODS & FORKS
4 OFF — IN STEEL
1/4" DIA
3/64"
SPRING TOP CAP
4 OFF — IN STEEL
1/8" DIA
FELT WASHER
FOR CAVITY — 4 OFF
1/16"
3/8"
SPRING TENSIONER
4 OFF — IN STEEL
DRILL Nº 18
DRILL Nº 30
TAP 3.BA.
1/64" CHAMFER
9/16"
1/16"
1/8" DIA
FORK PINS
4 OFF — IN STEEL
3/16" DIA
1/32" CHAMFER
1/32" SPLIT PIN HOLE
DRILL TO SUIT
A
5/16
2½" (SEE TEXT)
1/8" DIA
1/16"
1/4" DIA
3/8" DIA
3/16"
SECTION ON BEAM AT A–A
HEAD OF SMALL "ALLEN" SCREW
SILVER SOLDERED IN
4 BA.
1/4" DIA
3/8" DIA
1/8"
(SEE TEXT)
7/16
(THIS VIEW IN
REVERSE PROJECTION)
BEAM HINGE PIN
2 OFF — IN STEEL
2 OFF — 4 BA. STANDARD NUTS. STEEL

In such a case, it would be better to have a small hexagon-headed pin.

I have already told you about the origin of the springs I have used, and I do not seriously recommend your buying a whole box of these in order to get just four of the right size and tension. It might so happen that you have, tucked away, four springs very near those specified, varying only in diameter slightly, and provided that the diameter is not too big to sit inside the horn angle without rubbing against the sides, or too small to sit down on the tensioner without skimping the nut diameter at the skirt section, there is no reason why these should not be employed. Do not forget, however, that for a given size of spring-wire, the smaller the diameter of the wound spring, the greater the strength of the spring, so that allowances should be made for this factor.

Assembly

Fit the rods and forks to the beam, so that the heads of the fork pins are on the same side as the counterbore in the beam.

Fit the beam with its rods, to the underside of the axlebox, where the bracket is provided, so that the thickness of the beam is in line with the bracket fixing-bolts. Screw in the hinge-pin with an " Allen " screw key (where this is used) and hold it in position with it until the lock-nut is tightened up. Screw on the spring adjusters, slip on the springs and top caps, not forgetting the felt washers. Drop in the whole axle assembly, feeding the loose spring rods into the holes in the horns. When the assembly is complete, it should be possible to work the springing up and down with the same freedom as the more usual types of springing, generally specified for the small locomotive.

At least one of the advantages of the type of springing given for this engine, lies in its complete freedom from parts likely to loosen off. I think there is nothing more awful than having the experience of taking the engine out to a track at some place, often a long way from home, and then losing some vital springs or nuts after the first ten minutes of running.

Fortunately, this has never yet happened to me (touch wood) although I have seen quite a number of unlucky folk afflicted in this manner. Perhaps " unlucky " is not the right word, because, if such points were watched and designed correctly, it could never happen. I have nothing at all against the popular rods and underslung springs and nuts, especially as this constitutes full-size practice in a number of instances, but unless the rods themselves are prevented unscrewing out of the tapped holes in the axleboxes, and the tensioning nuts are locked or wired together as well, there is very little to prevent one losing the nuts altogether, to say nothing of the loss of correct (and all-important) adjustment.

I have noticed, from recent correspondence, that quite a few " Sisters " builders are making enquiries about " painting-as-you-go " methods. If painting is done carefully, and the job handled with respect as assembly goes on, this is the best method. I have already told one reader that the inside of the frames should be in signal-red, and the horn-cheeks should all be painted as well, except for actual working surfaces, of course. The only difference with the rear springing is that the beams and forks should be in dull black, with rods, pins and nuts left bright. The springs themselves, if of bright steel, would be better protected with the same dull black paint.

Machining Stainless-steel

Some time ago, I promised to give a few hints on the turning and general machining of the much-dreaded stainless-steel, and with some emphasis on the tool shapes and angles. The steels I have recommended in this series are so well mannered that much good and trouble-free work could be carried out with the conventional tool form. Looking around the workshops of a number of enthusiasts, and getting really " nosey " in the region of lathe toolposts, I have noticed a very marked tendency towards tools with very accentuated front and side clearances, even for normal mild-steel. In one or two cases I have reground the offending tool bits, and slightly staggered the owners, particularly with the improved turning properties imparted.

A really pronounced top and side rake is much more important, and this is made possible with the reduced front and side clearances, resulting in a cutting angle that does not leave the included angle of the tool too weak. Not only this, the habit of stainless-steel turnings coming away in a long and continuous and rather venomous strip of razor-edged aggression, usually straight for the operator's eye, is well known, at least with the harder grades of the metal, and the pronounced top lip acts as a chip breaker to some extent. No tool, whatever the ground shape and angle will give its best service if it is worked in its straight-off-the-grindstone state; and this applies to the turning of all metals other than the stainless-steels. In the case of the latter, an early failure is bound to occur, resulting in a bad finish no matter how low the speed and feed, and as stainless always finishes up with the best surface when rather heavy cuts are taken it would be as well to get accustomed to a new habit that will improve your turned work in every respect.

Get yourself a small pickle jar or meat-paste pot, about 3 in. high for preference. Fill this with paraffin, and if you have not already got any slip stones, buy some, standing them in the paraffin before attempting to use them. I recommend the fine Aloxite sticks (yellow colour) or best grade Washita stone, for all-round honing of lathe tools, and the selection should include stones of about $\frac{3}{8}$-in. to $\frac{1}{2}$-in. square section, thin flat stones with either vee-edges on one side, or just parallel, and a round section stone, usually about $\frac{5}{16}$ in. in diameter, although $\frac{1}{4}$ in. diameter would be even more useful; but such a small size is seldom seen in the average tool shop.

A triangular stone is also useful in dealing with the more elaborate forms of tools such as form tools.

You use these stones just as you would a very fine file, holding the tool bit firmly in the vice, and being careful not to slip over the edges of the cutting faces, and always well wet with paraffin. If you are in any doubt about the efficacy of this

form of treatment, apart from the more obvious results of using a honed tool, just take an unhoned tool bit, and examine it under a powerful magnifying glass, then compare it with a honed specimen. The first one looks like a bit of rough concrete which, when in use, gives rise to rubbing as well as cutting; this is just the condition to produce excessive heat at the tool tip, and away goes what is left of the cutting edge.

Stainless-steel has the property of producing a great deal of heat when turned, and the heat, not the hardness, does the damage.

That is why carbon-steel tools fail so quickly, even though their edge hardness is much greater than in any form of high-speed steel.

In certain cases, where extreme accuracy is required, such as in the turning of a really accurate thread, the carbon-steel tool is unbeaten; but to operate on stainless-steel in such circumstances would call for extra low speed of rotation, probably well below the normal range of back-gear speed, and a positively unbroken stream of a suitable coolant running over the tool tip. Unfortunately, stainless does not take too well to the water-base types of coolants, and prefers and oil-base lubricant, such as lard oil or a mixture containing lard oil; but as this does not possess the cooling properties called for, it is still possible to overheat the tool tip, and so the carbon-steel tool is really out of the picture for most turning jobs on stainless.

The standard high-speed tool bits stand up to the job very well indeed, although there are some variations in textures and hardnesses. The "Eclipse" Co. seem to cater for the small man better than do some of the other famous firms, and practically every tool shop has the standard tool bits. This steel is very hard, and works well on light to medium cuts. The famous "Stag Major" steel, well known to many who worked in production shops during the war, is a tougher if slightly less hard steel, and can be relied on to give every satisfaction in hard usage and heavy cutting. And there are others, practically all good reliable steels and having points suited to a wide range of machining conditions. I have obtained most excellent results with practically all these standard tool bits, plus a few other "Specials," and in nearly every case the machining has been done "dry," and with a minimum of fussing around with numerous light finishing cuts, which invariably means a ruined surface to the work.

This is where the accurate lathe comes into its own, and where the thimble on the cross-slide can be relied upon to give the exact feed-in as indicated by the numbers on it. For example, the work is "miked," showing that 30 thousandths are still to come off. The thimble is turned 15 thousandths exactly, with the certain knowledge that the final diameter will be perfectly correct.

This bold method is also a check on your tool grinding and honing; for if you know your lathe to be accurate, and the feed-screw not worn seriously, you should be able to enjoy this "dead reckoning" method with every confidence and, so far as stainless-steels are concerned, the best possible finish into the bargain.

(To be continued)

Petrol Engine Topics

(Continued from page 8)

Gudgeon-pin

This should be of mild-steel, case-hardened and highly polished, fitted to work smoothly in the little-end eye of the connecting-rod, and just slightly on the tight side in the gudgeon-pin bosses. The end pads, of brass or aluminium, should be pressed in and rounded off in position, checking the total length to ensure that it is less than the cylinder bore.

Flywheel and Collet

These components follow the same principles and general design as those in many of my other engines, and may be dealt with in the same way. That is to say, first rough out the outside of the flywheel to within about $\frac{1}{16}$ in. of finish size; then reverse, machine the back, and bore the tapered centre hole. Finish the outside by mounting it on a tapered mandrel; the part-machined collet may be used for this purpose if required.

To machine the collet, the essentials are that it should be concentric inside and out, and fit tightly on the shaft, also that the tapered external surface should be exactly the same angle as the flywheel bore. The fit on the shaft should be tight enough to enable it to be pressed on the latter after it is split, for minor finishing operations such as deburring and final tape fitting.

Some constructors have found it difficult to get a secure flywheel fixing with this type of collet, and have asked it if is practicable to pin or key the collet to the shaft. Well, it is, and the wide sawcut in the collet shown in the drawings *could* be utilised as a keyway to engage a small sunk key in the shaft; but I will again emphasise advice formerly given—*it should not be necessary* if due care is taken in machining and fitting. On no account should the shaft be drilled for a cross-pin at the flywheel end, and only a very small peg used to locate the timing of the cam at the other end. It is much better for the flywheel to slip under conditions of excessive torque load—so long as it does not do so under normal running conditions—than for the considerable inertia of the flywheel to be exerted, in the form of a shearing or distorting force, on a small key or pin. This lesson was learned through bitter experience by many early motor-cycle engine builders, who often had considerable trouble through burst bosses, sheared keys, and chewed-up shafts, when keyed outside flywheels were used; and I do not know of any reputable maker who keys the flywheels on nowadays.

(To be continued)

Novices' Corner

A Centre-punch Grinding Rest

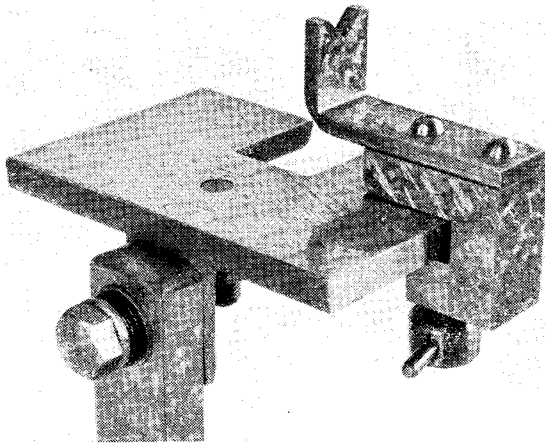


Fig. 1. *Showing the V-rest attached to the grinding table*

IN last week's article an extemporised rest for grinding centre-punches was described, but if this is made in rather more elaborate form it will be found a useful article of workshop equipment, and, at the same, time its construction will provide some interesting workshop practice.

The dimensions given, may, of course, have to be varied to suit a particular grinding machine.

The general arrangement drawing, or in this case the photograph in Fig. 1, is intended to show the worker what he has to make, and the working drawings in Fig. 2 give the dimensions of all the parts. The V-rest, part (1), is made from a length of ½-in. × ⅛ in. mild-steel strip, and before being cut to length, the position of the screw holes should be marked-out as already described and then drilled ⅛ in., but if it is found that these drill holes do not allow the ⅛-in.

Finally, the surfaces of the part should be given a good finish by careful filing with a fine file.

The clamp, part (2), is made from a piece of mild-steel 1 in. wide and ½ in. thick. The work is painted with marking fluid, and its contour is marked-out with the jenny calipers, but for this operation it is essential that the end of material should have been made square with its parallel sides by filing and checking with the try-square. An alternative method is to use one side for guiding the jenny calipers and to

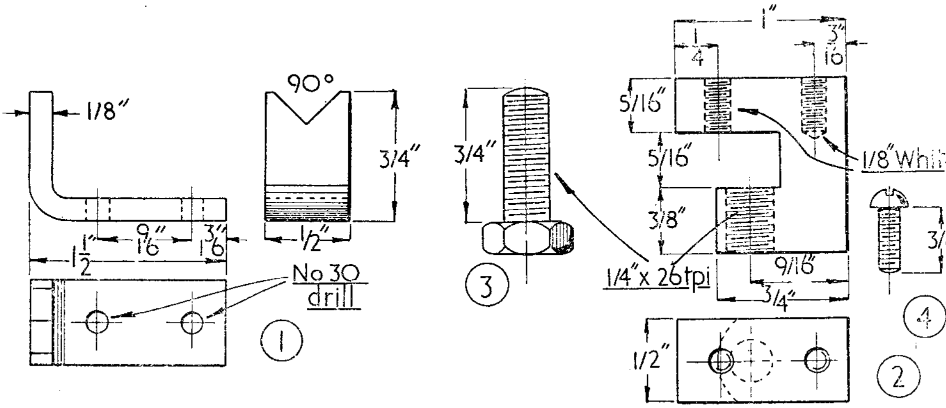


Fig. 2. *Working drawings of the grinding rest*

Whitworth screws to pass freely, then they should either be enlarged with a taper broach or a No. 30 drill should be put through. Next, cut off the part to length and clamp it in the vice with 13/16 in. projecting, then hammer over this portion to form a right angle bend.

The right-angled V can be cut roughly to shape with a small hacksaw and then finished with a triangular file. The inner surfaces of the limbs of the V should be bevelled to allow the punch, when in place, to turn freely.

apply the square to this side for marking-out the lines lying at right-angles.

The work is now cut roughly to shape with the hacksaw, and then finished to the given dimensions by filing.

If any difficulty is experienced in filing the sides of the part flat and to a good finish, it is best to rub the work to and fro on a large file to ensure accuracy. The next step is to drill and tap the blind hole, only, to receive one of the ⅛ in. diameter screws securing the V-rest in

position. To ensure easy tapping this hole should be drilled with a No. 39 drill and to a depth of $\frac{1}{2}$ in. to afford ample end-clearance for the tap.

When using the tap, care must be taken to keep it at right-angles to the work surface by checking its position from time to time with the square. The taper tap is first entered and is followed by the plug tap to form a full thread in the hole for a depth of $\frac{5}{16}$ in.

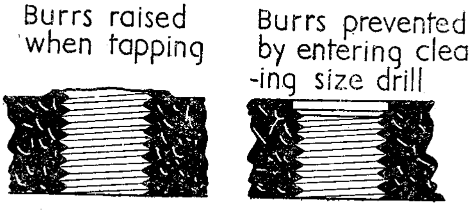


Fig. 3

The V-rest can now be attached to the clamp with the single screw, and the work is clamped in the machine vice with the jaws gripping both the V-rest and the clamp. Should the vice jaws not be sufficiently deep to do this, then a piece of material 1 in. wide by some $\frac{1}{4}$ in. thick should be placed in the vice on either side of the work to ensure that the V-rest is retained correctly in place on the clamp. A drill fitting the remaining hole in the V-rest is now entered for about 1/32 in. to mark the drilling centre and form a guide for the tapping size drill which follows. This drill is put right through the upper limb of the clamp and the hole is tapped as before. This method of working ensures that the two screws will enter their holes without binding.

When it was stated above that the clearing size drill should be entered in the clamp for a distance of about 1/32 in., it should in fact be made to enter for its full diameter to a depth equal to about $1\frac{1}{2}$ threads; this is to prevent the metal surrounding the hole from being raised in a burr when the tap is put in. This operation which is illustrated diagrammatically in Fig. 3 should always be carried out whenever a hole is drilled for tapping, and before the tap is entered.

It will be noticed that in the drawing in Fig. 2, showing the upper surface of the clamp, a curved broken line appears; this is the conventional way of indicating that a part lying underneath, namely the limb of the clamp, is formed with a curved surface. In this instance, the limb is finished to this form to give a more sightly appearance.

The under surface of the lower limb is now marked out with the jenny calipers to indicate the position of the clamp screw (3); and as previously described the tapping size hole is drilled with a No. 3 drill while the part is held in the machine vice.

For the clamp screw, a standard $\frac{1}{4}$ in. B.S.F. bolt $\frac{3}{4}$ in. in length may be used, or, if preferred, this part can be made specially for the purpose and will then, perhaps, as shown in Fig. 4, have a rather more workmanlike appearance. A length of $\frac{3}{8}$ in. diameter round mild-steel is secured in the machine vice and then cross-drilled with a No. 22 drill at a distance of 31/32 in. from the end. The methods employed for cross drilling shafts have been described so recently in THE MODEL ENGINEER that they need not be referred to here.

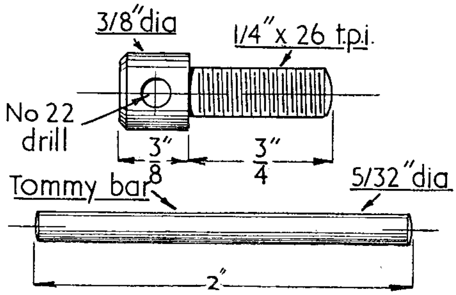


Fig. 4. *Alternative form of clamp-screw for the rest*

The rod is next gripped in the self-centring chuck, and after the end has been faced, it is turned down to $\frac{1}{4}$ in. diameter for a length of $\frac{3}{4}$ in.; the tip is then chamfered by taking a light cut with a V-pointed tool. Next, the turned portion is threaded $\frac{1}{4}$ in. $\times$ 26 t.p.i., by using the tailstock die-holder, or this operation can be carried out with an ordinary die-stock with the part held in the vice. The screw is then parted off, and after it has been reversed in the chuck, the head is turned, faced and chamfered as shown in Fig. 4. The tommy bar is made from a length of 5/32 in. diameter silver-steel, and its ends are chamfered in the lathe, but if preferred, a short cross-handle, like that seen in the photograph, can permanently be fixed in place.

This completes the work and the appliance can now be assembled ready for use.

Locomotive Castings and Parts

A. J. REEVES & CO. have favoured us with a copy of their 1950 catalogue which we can commend to the attention of our readers especially the locomotive-building fraternity. Its 24 pages are crowded with particulars and prices for castings, parts and materials for practically all "L.B.S.C.'s" well-known locomotives, as well as for the 0-6-0 tank engines "Gert," "Daisy" and "Vera" specially designed by Mr. A. R. Donaldson.

Other useful items include castings for bogies for making up passenger cars for $3\frac{1}{2}$-in. and 5-in. gauges; simple stationary steam engines; boiler fittings of all kinds; injectors; pumps; solders; lubricators; a very comprehensive range of materials; small tools, a few other workshop necessities and a wide selection of publications. The catalogue costs 6d., and should be interesting and useful to all owners of home workshops, not only to locomotive enthusiasts.

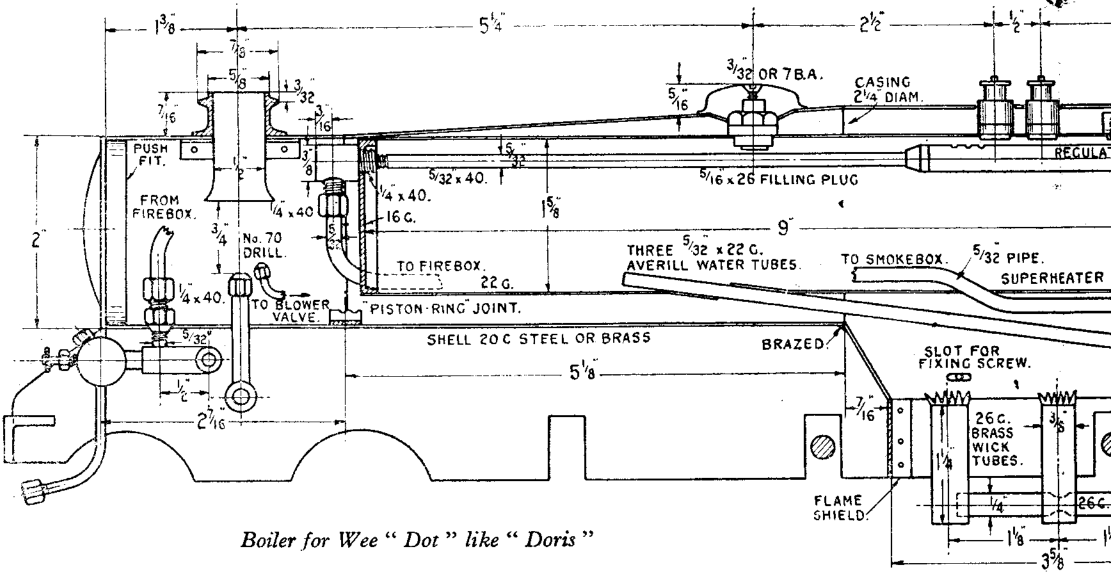
A Wee "Dot" ...

by "L.B.S. ...

BEFORE making and fitting the boiler, we shall need the steam and exhaust-pipes, and the lubricator, so make these the next job. The exhaust-pipe assembly should be fitted first. The centre part of this is a $\frac{1}{2}$-in. length of $\frac{5}{16}$-in. square brass rod, drilled 5/32 in. right through, and tapped $\frac{3}{16}$ in. by 40; an easy job in the four-jaw chuck. In the middle of one side, silver-solder an inch of $\frac{3}{16}$-in. copper tube; screw the end $\frac{3}{16}$ in. by 40 and fit a blast nozzle made from $\frac{1}{4}$-in. hexagon rod, with a 3/32-in. hole in it. The cross pipes are $\frac{3}{4}$-in. lengths of $\frac{3}{16}$-in. copper tube, screwed as shown in the illustration, and furnished with lock-nuts. Beginners note: to erect, all you do is to screw the cross-pipes into the tee until they touch, place the assembly between the cylinders, in line with the exhaust holes, and screw the pipes out of the tee, into the tapped holes in cylinders, until the short thread is right home at each side; then tighten the lock-nuts against the tee.

The steam-pipe assembly is on the same principle; but the tee is horizontal, the steam connection is on top of the stem, and the lubricator at the end, the whole issue forming one unit. The tee may be a casting, or cut from a piece of $\frac{1}{2}$-in. $\times$ $\frac{5}{16}$-in. brass bar, the unwanted part being sawn away. The head is drilled and tapped right through, 5/32 in. $\times$ 40, in the four-jaw; the stem is drilled up 5/32 in. to meet the cross-hole, and the end tapped $\frac{3}{16}$ in. $\times$ 40 for the lubricator. At $\frac{1}{2}$ in. from the centre of the head, silver-solder in a piece of 5/32-in. copper tube about $\frac{3}{8}$ in. long, screwed 5/32 in. $\times$ 40 for half its length. The cross-pipes are made and fitted, same as the cross-pipes for exhaust, except that they are 5/32-in., with smaller lock-nuts to suit.

The lubricator is a simple displacement affair with a weeny regulating valve. The tank is a piece of $\frac{1}{2}$-in. copper or brass tube about 22-gauge, with two discs of 18-gauge copper silver-soldered in the ends; it should just fit between the frames. The valve is made from a $\frac{15}{16}$-in. length of $\frac{3}{16}$-in. brass rod, with a valve pin of 3/32-in. rustless steel or bronze, $\frac{1}{4}$-in. wheel, and 5/32 in. $\times$ 40 gland. The filling plug is $\frac{3}{16}$ in. $\times$ 40, hexagon head, with a bush to match, which is silver-soldered into the tank, above the valve. The drain-pipe for condensate water is just a piece of $\frac{1}{8}$-in. copper tube long enough to reach to the buffer beam as shown; valve, bush, and drain pipe are all silver-soldered at one heat. The lubricator is screwed to the stem of the tee, and the whole bag of tricks placed in position as shown. The steam-pipes are run out of the tee into the bosses on the steam-chests, and the lock-nuts run back against the tee; anoint the threads on the pipes with plumbers' jointing before erecting. A screw run through each frame, into each end of the lubricator, prevents it falling down. If an adaptor is made to suit a motor tyre pump, and temporarily screwed on to the bit of 5/32-in. pipe on top of the tee, the "works" can be tested by air pressure. The wheels should turn equally well in either direction, you can gauge the power by holding a wheel with your fingers. A vigorous stroke of the pump will probably snatch it away; whilst if the chassis is placed on the floor, one or two strokes should send it careering across the workshop.



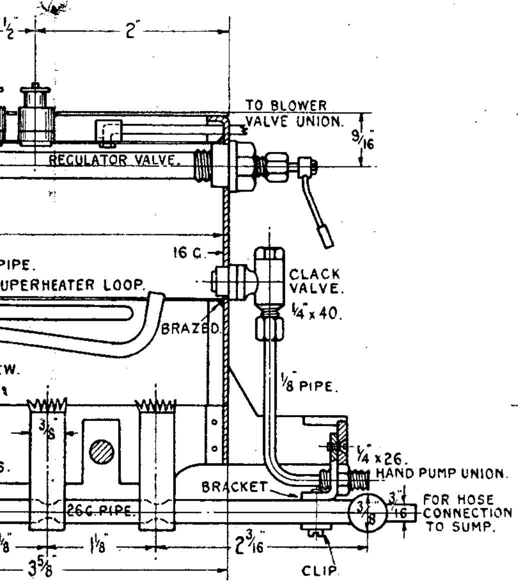
Boiler for Wee "Dot" like "Doris"

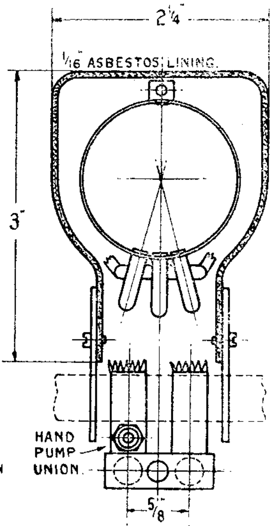
...t" like "Doris"

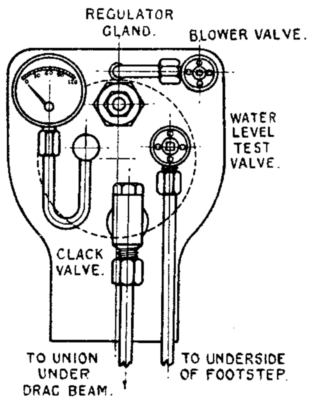
...'L.B.S.C."

Boiler

The outer casing of the water-tube boiler is similar to that specified for "Doris," made to the given dimensions. In this little engine, there is no need to slope the firebox wrapper back; leave it parallel, then one former will do for throatplate and backhead. The best stuff to use for the wrapper would be sheet steel of about 20-gauge; this doesn't conduct heat







Arrangement of backhead fittings

away like brass, though the latter can, of course, be used if preferred. The smokebox may be either a bit of 2-in. tube, or rolled up; doesn't matter which; it is attached to the boiler case, after the inside barrel has been fitted, by a "piston-ring" joint. The taper part of the boiler is easily rolled up, with a $\frac{3}{16}$-in. lap seam underneath, secured by a few $\frac{1}{16}$-in. rivets; no need to braze it unless you wish. The firebox wrapper is bent up as described for "Doris," the throatplate being flanged, and secured by a few rivets. The large end of the barrel is simply placed over the hole cut in the throatplate, and brazed, the joint between throatplate and wrapper being filled in with brazing material same time. The holes for dome and safety-valves are cut, as shown in the illustration.

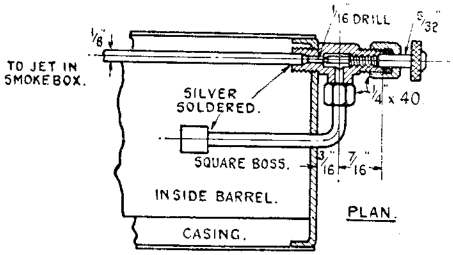
The backhead is knocked up from 16-gauge copper sheet. The inside barrel, which is a 9-in. length of $1\frac{5}{8}$-in. × 22 or 20-gauge seamless copper tube, is brazed to it, the outer end being closed by a brazed-in flanged disc of 16-gauge copper. The three 5/32-in. × 22-gauge water-tubes are put in on the late Mr. T. W. Averill's method, with straight front ends. For beginner's benefit, you just drill the three holes, poke a bit of 5/32-in. steel rod in each, and force it down to the angle shown for the tubes. This distorts the hole in the barrel, sufficiently for the tubes to be inserted. Note the bends at the rear end are 90 deg. only; not the acute bends which you see on commercial engines with this type of boiler. Fit the bushes for filling-plug under dome, for safety-valves, and for footplate fittings, then silver-solder tubes and bushes at one heat.

Boiler Fittings

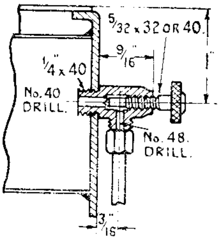
The boiler fittings are cut down to the minimum. In addition to the filling-plug and safety-valves, we need just a regulator, blower, feed-clack, test-cock, and steam-gauge. No water gauge is required; a few strokes of the hand-pump every three or four minutes, will maintain water level. Even if the boiler runs dry, it doesn't matter a bean; the heat from a "poison-gas plant" cannot hurt a brazed boiler of this type, neither will it hurt if you pump water in, although the pressure-gauge needle will get a bad shock on the first stroke or two! These tiny boilers will stand more "rough-housing" than big ones.

The regulator is nothing more than a glorified screw-down valve, with a body as long as a Jerry poodle, this being made from a piece of $\frac{1}{2}$-in. hexagon brass rod measuring $3\frac{5}{16}$ in. long, after both ends have been truly faced. Centre each end, and drill down with No. 30 drill until the holes meet in the middle and form a thoroughfare. Turn down 3 in. length to $\frac{5}{16}$ in. diameter; beginners—and anybody else whose lathe is a bit "off colour"—had better do this job between centres. Then further reduce $2\frac{3}{4}$ in. length to

9/32 in. diameter, and screw the odd $\frac{1}{4}$ in. $\frac{5}{16}$ in. × 32 or 40. Hold the hexagon end in the three-jaw, and run up the tailstock until the centre point enters the hole in the round end. Then, if you screw the chuck jaws tightly down on the hexagon, and pull the tailstock away, the "dog's body" part should run truly. Open it out to 1 in. depth with a 9/64-in. or No. 27 drill, and tap it $\frac{3}{16}$ in. Whitworth; the coarse thread gives the regulator a quick action. Starting at 7/32 in. from the end, drill three $\frac{1}{16}$-in. holes close together, as shown, clearing out any burrs by running the tap in again. Hold the barrel part in three-jaw, and turn down the hexagon end to $\frac{1}{4}$ in. diameter, screwing for the gland-nut as shown, leaving enough hexagon to form a spanner hold when screwing the regulator into the backhead bush.



Blower-valve assembly



Water level test-valve

Turn up a nipple for the tapped end, from $\frac{5}{16}$-in. brass rod, as shown; this must be faced truly at the spigot end, to form the seating for the valve pin. This merchant is made from a bit of $\frac{3}{16}$-in. rustless steel or bronze rod held in three-jaw. Turn down $\frac{5}{16}$ in. length to $\frac{1}{8}$ in. diameter, and form a cone point on it; beginners note that this may be done by a few strokes of a fine file, swept across the end of the rod with the lathe running fast, holding the file at the right angle to suit the cone. Screw the next $\frac{5}{16}$ in. length with $\frac{3}{16}$-in. Whitworth die, and part off. Reverse in chuck, centre, and drill in a little way with $\frac{1}{8}$-in. drill. Drive a bit of $\frac{1}{8}$-in. rustless steel or bronze rod into the hole, and silver-solder it. The outer end has a square filed on it for the regulator handle (I have shown L.M.S. pattern, but any kind you fancy will do equally well) and reduce the extreme end to $\frac{1}{16}$ in. diameter, screwing $\frac{1}{16}$ in. or 10 B.A. for retaining nut. The sectional illustration shows how to assemble the whole bag of tricks; screw a 6-in. length of 5/32-in. copper tube into it, both ends of the tube being threaded, and screw the regulator into a bush, tapped to suit, silver-soldered into the backhead at the position shown. The other end of the pipe should just be showing through a $\frac{1}{4}$-in. × 40 hole in the plate at the front end.

The front end elbow is a $\frac{5}{8}$-in. length of $\frac{3}{8}$-in. brass rod, with a $\frac{1}{2}$-in. deep hole in it, drilled No. 30 and tapped 5/32 in. × 40 for the steam pipe. The end is reduced to $\frac{1}{4}$ in. diameter for $\frac{3}{16}$ in. length, and screwed $\frac{1}{4}$ in. × 40. A $\frac{1}{4}$-in. × 40 union nipple is silver-soldered into the side. Put a taste of plumber's jointing on the external thread, and on the steam pipe threads; then when the elbow is screwed home as shown, there will be no chance of steam leakage. The superheater loop is attached to the nipple by a nut and cone, the length of the loop being approximately 22 in. It runs back along one side between boiler and casing, passes between water-tubes and barrel as shown, returns along the other side, and terminates in a swan-neck, which will be attached by a union fitting to the little vertical pipe on the steam tee, when the boiler is erected. The arrangement is shown in the longitudinal section of the boiler.

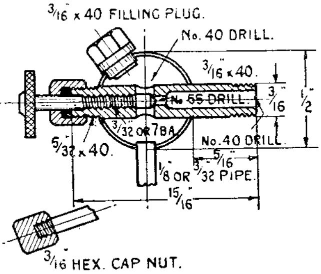
I have described in full detail, how to make screw-down valves, clacks, and other etceteras so many times, that there is no need to go into the whole rigmarole for this job. Anyway, the illustrations of the backhead fittings are practically self-explanatory. The blower-valve takes steam from a connection on the barrel about $1\frac{1}{4}$ in. from the backhead. This is a little block of $\frac{1}{4}$-in. square brass rod, with a spigot turned on it, to fit a $\frac{3}{16}$-in. hole drilled in the barrel. Drill a $\frac{1}{8}$-in. hole in one of the facets, and drill No. 40 through the spigot, to meet the other hole; then put the block in place. Fit a union nut and cone to a bit of $\frac{1}{8}$-in. copper tube about $1\frac{3}{4}$ in. long. Drill a No. 30 hole in the backhead just above the barrel; poke the end of the tube through it, and enter it in the block. Silver-solder the block to the barrel, and the tube to the block, at the same heat; with the thin metal, a direct application of the blowlamp flame will do the trick. Make up a blower-valve as illustration, and silver-solder a piece of $\frac{1}{8}$-in. copper tube into it, about 11 in. long; the outer end of this should be screwed 5 B.A. Drill and tap a $\frac{1}{4}$-in. by 40 hole in the top right corner of the backhead; poke the long pipe through it, and screw the valve home, the nipple on same being set horizontally. Bend the end of the blower pipe around to meet it, and couple up. Fit a weeny nozzle on the outer end, with a No. 70 hole in it, and set it alongside the blast nozzle, so that the jet of steam will blow up the chimney liner. If it won't "stay put," tie it to the blastpipe with a bit of thin wire.

The test-cock is made exactly the same as the blow-down valve specified for my water-gauges, and is shown in section. Screw it into the backhead at 1 in. from the top, and $\frac{1}{2}$ in. to the right of the centre line. A $\frac{1}{8}$-in. pipe is connected to the valve by a union nut and cone, the outer

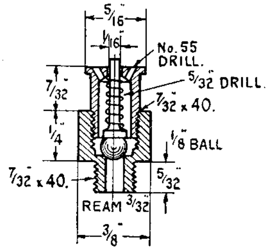
end being taken to some point where you can see it easily ; say to the underside of the step, like an injector overflow. When filling the boiler to start from all cold, either pour water in via the filling-plug, or pump it in with the hand-pump in the tender, until water runs out of the pipe. Leave the valve open whilst filling, to let air escape from the boiler.

The steam-gauge fitting is made exactly the same as the blower connection ; but the block may be round instead of square, and screwed into the backhead if you prefer it. The pipe is bent

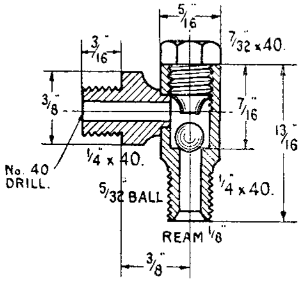
No. 50 drill, open out to $\frac{5}{16}$ in. depth with 5/32-in. or No. 21 drill, turn down $\frac{5}{16}$ in. length to 7/32 in. diameter, screw $\frac{1}{8}$ in. length 7/32 in. × 40, and part off at $\frac{3}{8}$ in. from the end. Drill four No. 55 holes in the top, pepper-box fashion. The ball, cup and spindle, and spring are fitted, same as I have described for valves of the usual type, and the assembly is shown in the little illustration. The pressure is adjusted by screwing the nipple up or down, as usual. As only the 7/32-in. column projects above the firebox casing, the appearance of the valve is correct.



Lubricator



Safety-valve



Feed clack

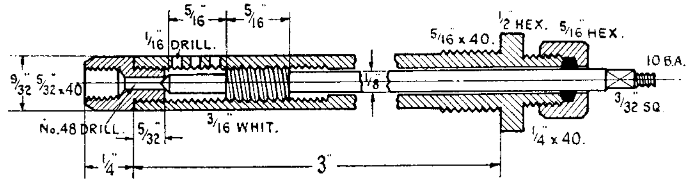
to U-shape ; and the steam gauge, which should be $\frac{3}{4}$ in. diameter, reading to 120 lb., is attached to the union as shown. The feed clack is just one of my standard clackboxes, screwed into the backhead as shown ; the $\frac{1}{8}$-in. pipe from this, goes down through the footplate to the underside of the drag beam, where it is attached to a $\frac{1}{4}$-in. × 26 union screwed through the upper part of the bracket which holds the feed tubes of the burner in position. The coarser thread gives quicker attachment and far more lasting wear than the usual 40, in this case.

The safety-valves are similar to those I schemed out for a close friend of Inspector Meticulous, who wanted " scale " safety valves

Assembly and Erection of Boiler

Line the inside of the firebox casing with $\frac{1}{16}$-in. asbestos millboard. If you damp it, the stuff can be moulded to the casing without breaking ; and a couple of strips of metal about $\frac{3}{8}$ in. wide and 2 in. long, one at each side of the lower part of the casing, will keep it in place. They can either be riveted with two $\frac{1}{16}$-in. rivets in each (one at each end) put through the lot—casing, asbestos, and strip—or screws can be used, nutted inside. The boiler is just slid into the casing, and secured by a few $\frac{1}{16}$-in. or 10-B.A. screws put through No. 50 holes in the edge of the wrapper, into tapped holes in the backhead flange.

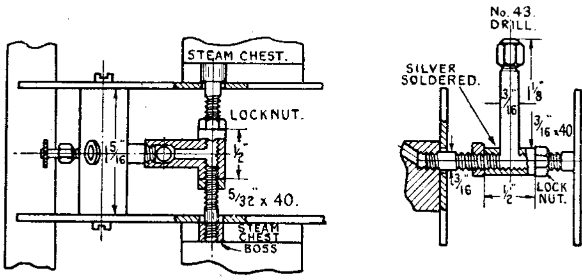
(Right) Details of egulrator



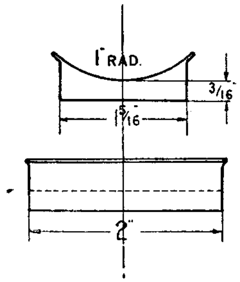
on a $2\frac{1}{2}$-in. gauge engine. He got the " scale " appearance, though he didn't get " scale " valves ! These were large enough to be effective, owing to each valve being housed in the block below the column. In the present case, chuck a piece of $\frac{3}{8}$-in. bronze or gunmetal rod, face the end, centre, and drill down about $\frac{1}{2}$ in. depth with No. 44 drill. Turn down 5/32 in. of the end to 7/32 in. diameter and screw 7/32 in. × 40. Part off $\frac{1}{4}$ in. from the shoulder. Reverse in chuck, open out the hole to $\frac{3}{16}$ in. depth with $\frac{3}{16}$-in. drill and D-bit, or easier still, use a pin-drill ; tap 7/32 in. × 40, and poke a 3/32-in. parallel reamer through the remnants of the small hole at the bottom. For the nipple, chuck a piece of $\frac{5}{16}$-in. rod ; face, centre, drill to $\frac{1}{2}$ in. depth with

The smokebox saddle may either be a little casting, or built up from 18- or 20-gauge sheet metal, to sizes given. You can see where to put it, in the general arrangement drawing published in first instalment ; it is set so that the bottom of the radius is level with top of frame, and fixed with three $\frac{1}{16}$-in. or 10-B.A. countersunk screws at each side. Drill clearing holes in the bottom of smokebox, for pipes to pass. Place boiler in position, and set it level ; then drill a No. 48 hole at each side of frames, anywhere between the wheels, and tap it 3/32 in. or 7 B.A. Remove boiler, and put a No. 40 drill through the holes in the wrapper ; then elongate them into little slots with a rat-tail file. Replace boiler, and put screws in ; the slots will allow for expansion of

boiler when hot. To fix the front end down, utilise the steam union. Chuck a bit of $\frac{5}{16}$-in. hexagon brass rod; face, centre deeply, and drill down about $\frac{1}{2}$ in. depth with No. 30 drill. Turn a bare $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, and screw for the union. Part off at $\frac{1}{2}$ in. from the end; reverse in chuck, turn about $\frac{3}{16}$ of the end to a taper, and tap the hole $5/32 \times 40$. Screw this on to the end of the bit of tube projecting up from the steam tee into the smokebox, so that the taper fills the hole, and holds the smokebox down; a bit of plumber's jointing on the threads, and around the taper, will keep it steam-and-air-tight. Put some around the blast-pipe as well. Connect up the end of the superheater loop to the union, and Bob's your uncle. The front of the smokebox is a casting, complete with door and hinges cast on. It is turned to a push fit in the front of the smokebox. The chimney and liner are a half-size edition of those specified for "Doris," and fixed in the same way. The dome casting, after being turned, is attached to the top of the filler screw by a 3/32-in. or 7-B.A. countersunk screw. The complete assembly is shown in the illustration.



Steam and exhaust pipes



Smokebox saddle

Firing Arrangements

The easiest method of firing the boiler is by a six-burner "poison-gas plant," but if your blast and blower are O.K. you'll take all the poison out of the gas! The burners are six $1\frac{1}{4}$-in. lengths of $\frac{3}{8}$-in. brass tube, not thicker than 26-gauge, or thinner if you can get it. These are mounted on two pieces of $\frac{1}{4}$-in. tube, also as thin as possible, holes being drilled, or half-round nicks filed, at the points where the feed-pipe passes through the burner. Discs of thin brass close the bottoms, and the whole issue is silver-soldered at one heat for each unit. Both units are silver-soldered to a cross-pipe or drum, made from same stuff as burner tubes, closed at each end; a short bit of $\frac{3}{16}$-in. pipe is silver-soldered into the back of the drum, for connection to tender by a rubber hose. A bracket 1 in. long is bent up from 13-gauge sheet metal, and attached to the drag-beam by two screws, as shown in the illustration; a piece of 16-gauge metal, 1 in. long and $\frac{5}{16}$ in. wide, holds the feed tubes to the underside of the bracket, and is itself held up by a solitary 3/32-in. or 7-B.A. screw, passing between the feed pipes and entering a tapped hole in the bracket. Use asbestos string or flock for wicks.

An oil burner may be fitted if desired; the "axle-dodger" type shown on the blueprint of my oil burners issued from our offices, could be reduced to suit, and would make enough steam to haul a couple of kiddies continuously. There is no need for separate instructions and drawings for the superstructure, as the running-boards, cab, and trimmings are all made like those for "Doris," but to half the given sizes. Now all we need, is a suitable tender; so I will, all being well, dispose of that in a final instalment.

A Lincoln "Double"

(*Continued from page* 9)

Rodway were given a trip behind "Bantam Cock," and at the end of his trip Alderman Doughty stated it was one of his greatest thrills.

While the locomotives were being prepared for passenger-carrying, attention was next centred around the race car track, where several fast runs were made; unfortunately the electrical timing gear had not been completed, so accurate timing was not possible.

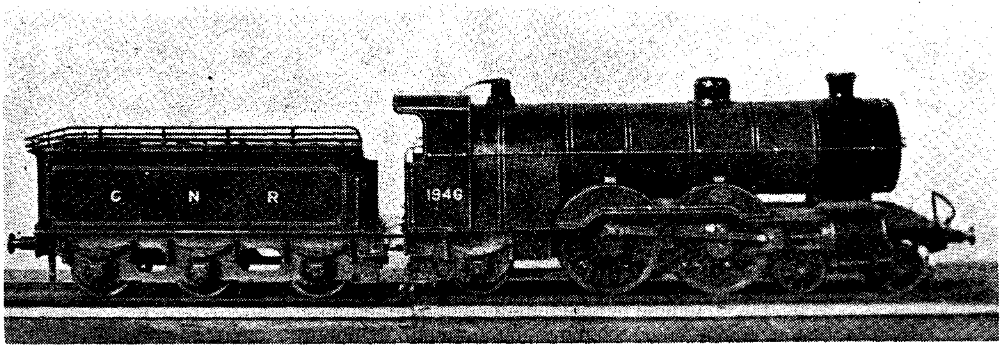
Among the cars running were Mr. C. Bunn's 10-c.c. D-type E.R.A., Mr. L. Goodacre's 2.5-c.c. free-lance and Mr. H. Butler's 2.5-c.c. D-type E.R.A.

Unfortunately, rain "stopped play" at tea-time, but in the meantime, well over 300 passengers had been carried.

The multi-gauge locomotive track consists of a 400-ft. oval, comprising two 90-ft. straights and top and bottom curves of 34 ft. radius. Construction is of concrete arches resting on footings cast in position. Arches are of 6-ft. span and are 16 in. in height. Rails are laid in a trough cast in the top of the arches, and consist of 9 ft. lengths of 1-in. $\times$ $\frac{1}{4}$-in. mild-steel bars, held apart by tubular spacers.

The race car track is laid out inside the rail track and consists of a ring of concrete 3 ft. wide, 42 ft. diameter, and is cast in six sections, all correctly reinforced.

The timing-gear is of the electrical contact type, the contacts being actuated by the centre tether-arm.



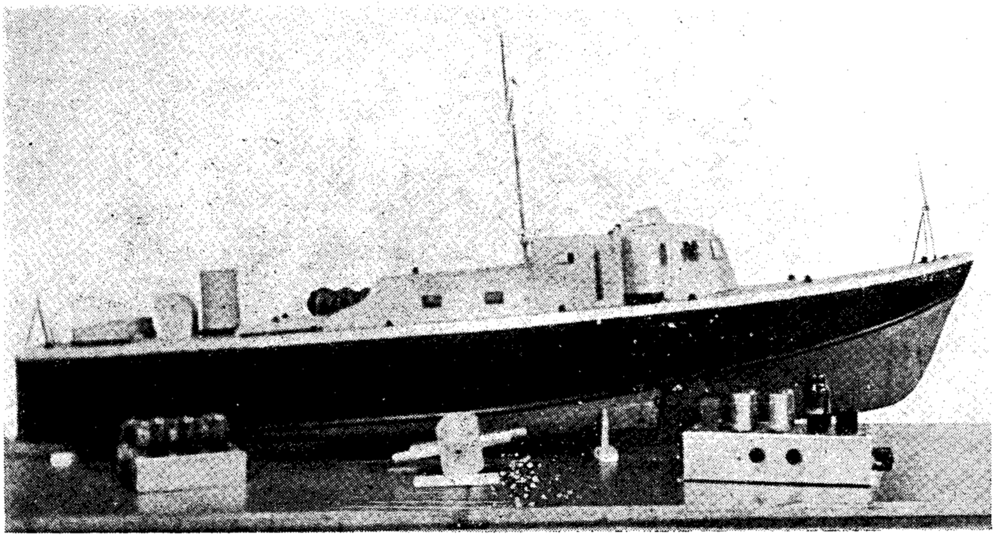
A 3½-in. gauge " Maisie " by Dr. G. Turner, of Oswestry

Shrewsbury and District S.M.E. Exhibition

AT the society's third exhibition, held recently, the attendance was excellent, no count was taken, but it is estimated that well over 2,000 people visited the show, some from as far away as Chingford, Machynlleth and Rhyl. The multiple-gauge track was not used this year, as no locomotive was available. This defect will shortly be remedied, as a 5-in. gauge 0-4-0 locomotive —a club effort by a number of members—is being built.

Rather more than a dozen models were running on compressed air, including a very fine " Hielan' Lassie " chassis by R. M. Cadwallader, on a 12 ft. length of track. Some very careful " tap-twiddling " was necessary to keep it on the lines, as its acceleration on 25 lb. pressure is phenomenal.

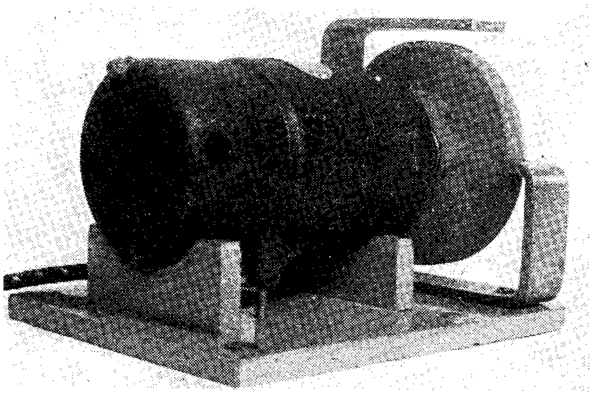
The standard of work both from the Shrewsbury and Oswestry societies, was higher than ever, and in addition to the usual run of models included the following: Miniature circus, hand-carved from scraps of wood, by J. J. Mills, Shrewsbury; experimental 5-in. centre lathe, an infinitely variable hydraulic drive unit by C. Golding, Shrewsbury, and a 6-ft. Vosper A.S.R. launch under construction by R. A. Young, Oswestry, with radio control, and experimental opposed-twin steam engine. Of this last, a visitor who had worked on Vospers, wanted to know if its constructor had seen service on one, it was so lifelike.



The 6-ft. model of a Vosper A.S.R. launch by R. A. Young

Grinders for Bench and Lathe

The conversion of ex-R.A.F. apparatus into valuable workshop equipment.—by P.B.D.

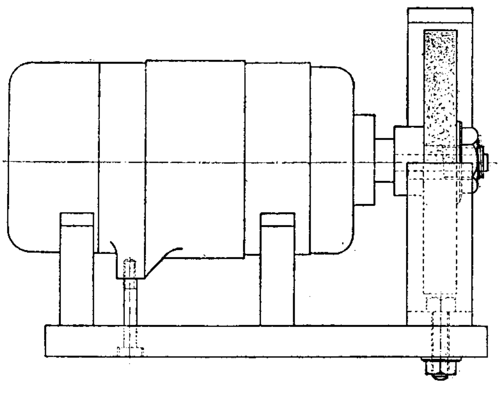


General view of motor-driven grinder

A CONSIDERABLE amount of surplus Government stock is available at present and quite a fair amount of this material is useful to the amateur mechanic and research worker.

How often have we peered through shop windows at something which resembled an electric motor, marked 24 volts d.c. and wondered if it would possibly run off a.c. supply. How often have we seen those rotary converters, generators and camera motors and again wondered if they would run satisfactorily as motors on a.c. supply and if so, just how much power they would develop. At this stage the author must make the statement that frankly he knows nothing of rotary convertors or generators, but can offer a little information on the adaptation of camera motors to useful power tools.

The motors shown in the photographs are the type fitted to an American make of aero camera, the type, I believe, being the K.24. As purchased they were actually new spares for these cameras and were packed in their original containers. The nameplate showed the motors to have been made by Delco, of America, and the voltage was 24 d.c. On stripping, it soon became obvious that the field winding and laminated armature were series-wound and this showed that the motor should be capable of running satisfactorily on either d.c. or a.c. supply.



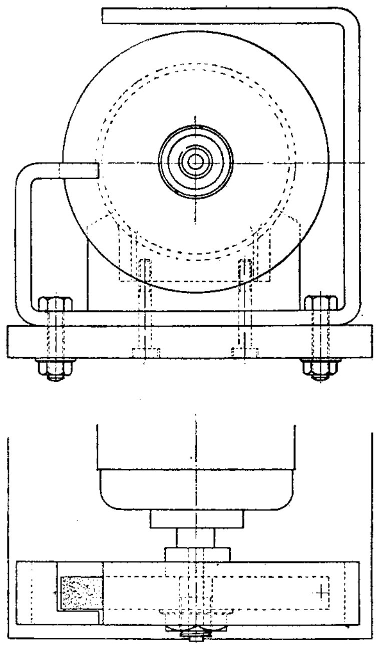


FIG. I

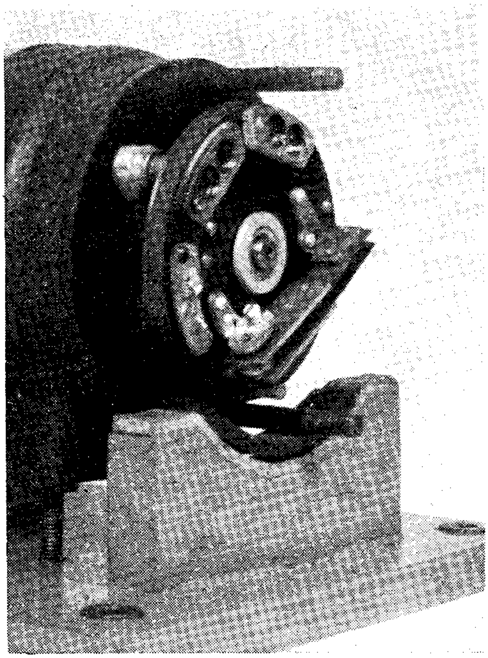
SKETCH SHOWING MOTOR ARRANGED AS A BENCH GRINDER

To control the speed, a centrifugal make-and-break contact is fitted on the commutator end of the shaft, and by means of a small screw the contacts can be adjusted to control the speed between approximately 1,000 and 7,000 r.p.m. The motors have two pairs of leads, whereby one circuit operates the motor controlling the speed with this make-and-break contact switch which is virtually a centrifugal cut-out, and the other circuit runs the motor as a normal series type at a speed probably in the region of 15/20,000 r.p.m.

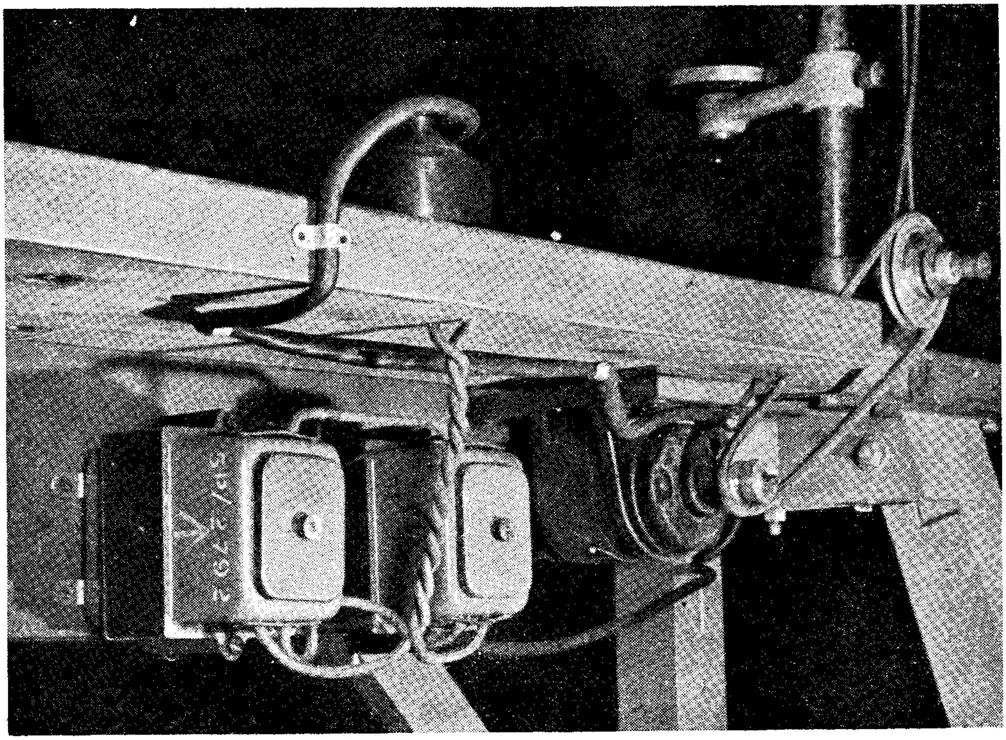
Fig. 1 shows the motor adapted to a bench grinder, the wheel being mounted on to an adaptor as shown in Fig. 2 and a guard and tool rest combined as shown in Fig. 3 ; the mounting for the motor was made in wood although a more elaborate one could be cast in aluminium. The 4-in. wheel runs at 5,000 r.p.m. which corresponds to the recommended surface speed for the general type of wheel, this being the controlled speed of the motor using the circuit employing the centrifugal cut-out.

Another application for this type of motor can be seen in the photograph showing a ¼-in. drilling machine, driven from beneath the bench. The speed is again about 5,000 r.p.m. reduced to give a spindle speed of 1,000 r.p.m. on the drilling machine, the motor providing sufficient power to drill ¼-in. holes in steel, which speaks well for the power of these small motors.

Still another useful purpose can be served in the form of a toolpost grinder, and although I



Close-up of centrifugal switch



View showing transformers and drive to drilling machine

have one of these in the making, it is too early at this stage to include a photograph with this article. Fig. 4 shows the proposed arrangement and for this purpose a slight alteration has been made to the motor in order to reduce its size. It will be seen in one of the photographs, that the cover has been removed and the working of the centrifugal cut-out is, I hope, visible in the reproduction. In order to utilise a motor in the design of the toolpost grinder the centrifugal cut-out was removed and the width of the cover reduced, thereby shortening the length of the motor by 1 in.; this means the speed will now be uncontrolled as has been said before at about 15/20,000 r.p.m. Since the duties of the toolpost grinder are to grind internally as well as externally, this speed is quite satisfactory for wheels up to say $\frac{3}{4}$ in. diameter by making the pulleys twin-grooved on the motor and stepped on the grinding wheel spindle we can provide for both speeds, say, 6,000 and 20,000 r.p.m. It is intended to use a 5/32 in. diameter endless leather belt or possibly a rubber one for this drive, but I have the feeling that the friction will be rather excessive necessitating the making of a slight alteration in the design in order to use an endless woven belt.

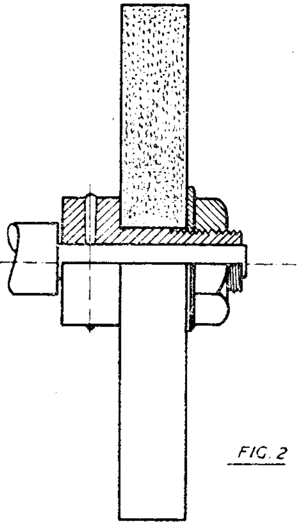


FIG. 2

GRINDING WHEEL ADAPTOR.

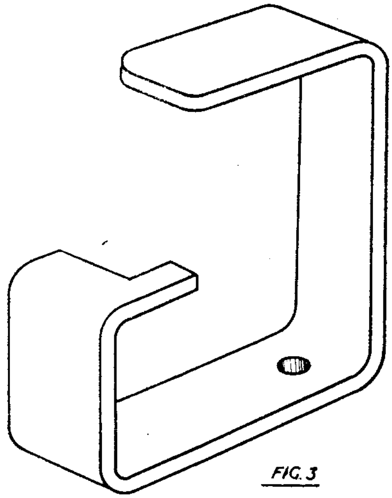


FIG. 3

COMBINED GUARD & TOOL REST

The greatest disadvantage with these products seems to be the low voltage, but again for a small sum, excellent value can be obtained in transformers at a fraction of their original price. In my case, a 230 V input and 24 V output transformer was not available at the time, so two 110 V inputs and 12 V outputs were purchased with the intention of wiring them in series and thereby obtaining the necessary input and output.

The maximum current output per transformer is 8 A, if the output therefore is wired in series, 24 V at 8 A is obtained, whereas if they are wired in parallel, 12 V at 16 A is the output. The photograph shows them mounted under the bench and wired to a 15 A socket on the bench top whereby a 24 V supply is permanently available.

In conclusion, I hope that these three applications of the use of surplus war equipment will prove of interest.

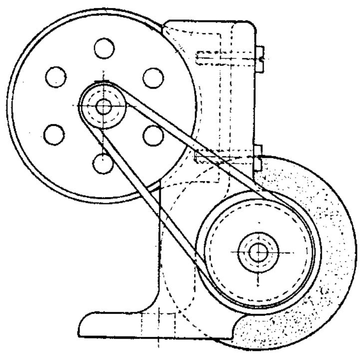
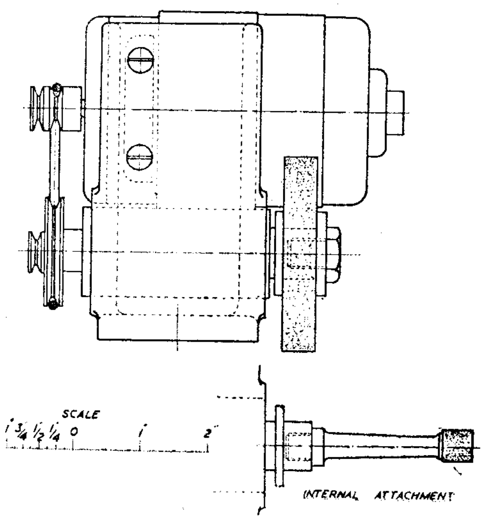


FIG. 4



SKETCH SHOWING MOTOR ADAPTED TO A TOOL POST GRINDER FOR THE LATHE

TEST REPORTS

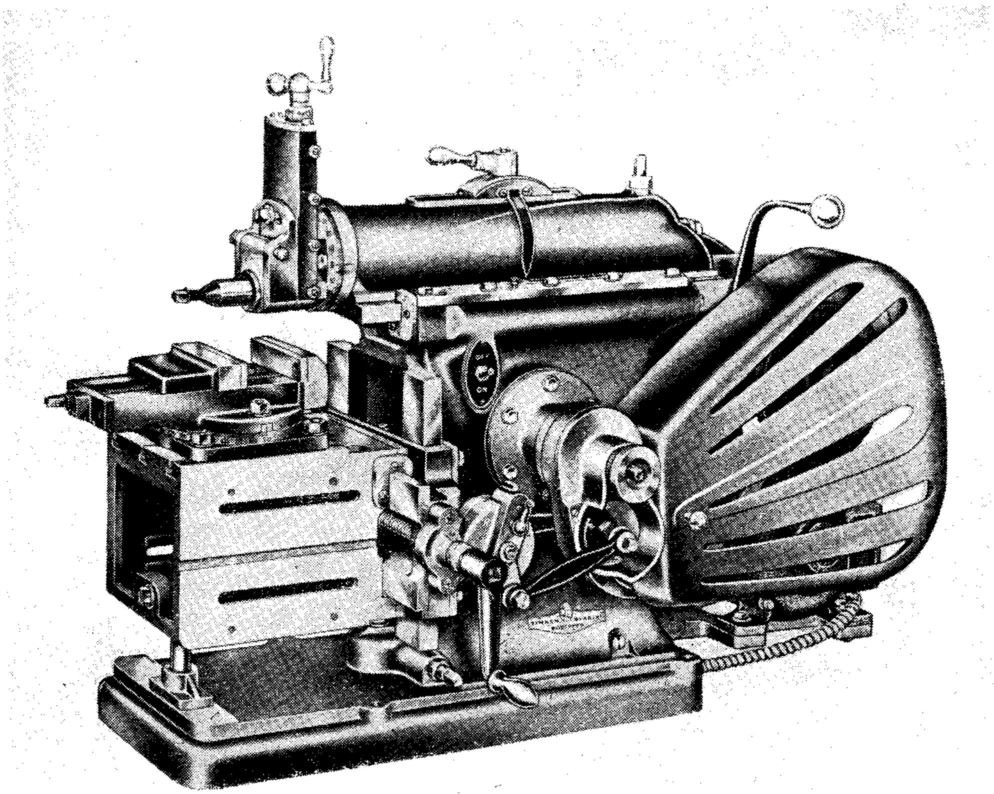
Some expert comments upon items submitted by the trade

The Acorntools 7-in. Shaping Machine

ALTHOUGH we are staunch advocates of producing good work solely with the aid of the rather limited equipment usually found in the small workshop, nevertheless, we know there are many enthusiasts who, perhaps later in life, derive great pleasure from supplementing their range of tools with others of the more expensive type, which make a strong appeal by reason of their high-class workmanship and more elaborate design. Furthermore, where spare time is limited, a shaping machine may save much laborious filing, and, if the machine is power-driven, not only is less hard work required, but many operations can be carried out much more quickly. Moreover, although the lathe will machine flat surfaces effectively, the area of these surfaces is limited by the capacity of the saddle and the traverse of its slides.

It is not that we would like to see hand-filing displaced by machining operations, for the skilled use of the file is fundamental to the engineering craft.

With these observations in mind, we have chosen for the subject of this first report the Acorntools power-driven shaping machine. A first sight, this machine is obviously built up to a standard and not down to a price, and this becomes even more apparent when the details of its construction are examined more closely. Moreover, the weight of the machine, 320 lb., will give some idea of its robust construction.



A machine of this type is necessarily somewhat complicated and it would hardly be profitable to attempt to describe all the constructional details in a short article, but the main features of the machine are illustrated in the photo above.

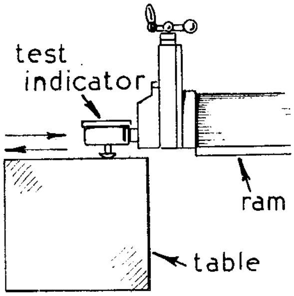


Fig. 1

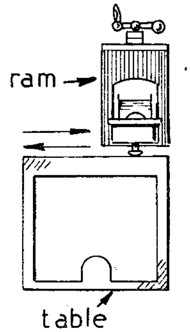


Fig. 2

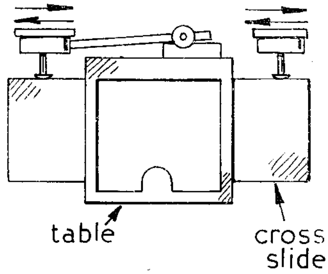


Fig. 3

A ½-h.p. Hoover electric motor of the capacitor-start type is secured to a hinged table, adjustable by means of a lifting screw for setting the tension of the primary V-belt. Thence, the drive is taken to a countershaft running in needle-roller bearings and carrying a four-speed V-pulley, as well as a brake drum, at its right-hand end. The ball-ended lever, seen at the right top corner of the photograph, actuates a cam mechanism which raises the countershaft and so tightens both driving belts. When this lever is fully depressed, the belts cease to drive and, at the same time, a brake shoe is pressed against the brake drum.

The second V-belt conveys the drive to the pinion shaft, which runs in Timken roller-bearings, and also carries a four-step V-pulley. A 15-tooth pinion attached to this shaft drives the 80-tooth wheel on the crankshaft; both wheels are 1 in. in breadth across the tooth face. The crank-pin, driving the rocking lever which actuates the ram, is fitted with a mechanism, operated by skew gears, for altering the crank throw to set the ram stroke.

The Ram

The slides on the ram are 16 in. in length and are carried in two slide-ways 12 in. in length formed in the main column. The slides are fully adjustable for wear by means of a vertical gib-strip and laminated shims fitted to the horizontal bearings plates. A tray is attached to the rear face of the column to catch any oil drips from the ram slides.

The position of the ram in relation to the work can be set by means of a shaft, situated towards the rear of the machine, and a pair of bevel gears actuating a threaded draw-spindle. The adjustment of the ram stroke is made with reference to a pointer and a scale attached to the ram slide. The ram head carries an adjustable angular slide furnished with a clapper-box having a bearing pin adjustable for wear; this slide is provided with an adjustable gib strip, and an adjustable graduated index collar is fitted to the feed screw. An American pattern toolholder with a single clamping-screw is fitted to the clapper.

By means of the four-speed belt drive, ram speeds of 40, 66, 102 and 170 strokes per minute are obtainable, and as the length of the ram stroke can be varied from ½ in. to 7 in., this gives cutting speeds ranging from 3½ to 100 ft. per minute.

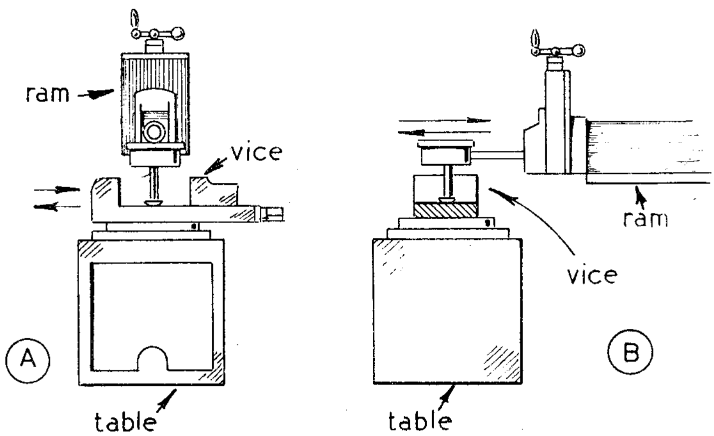


Fig. 4

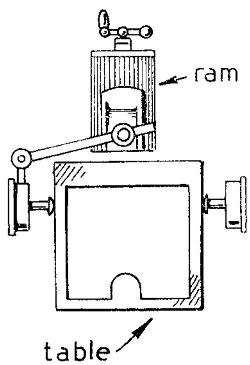


Fig. 5

The Table Slides

The table itself is of box form and its surfaces are finished by surface grinding ; it is carried on a cross-slide, and a gib strip and laminated shims are fitted to provide for adjustment. The feed screw, which is equipped with an adjustable index collar, can be operated either by a handle or by an automatic feed mechanism coupled to

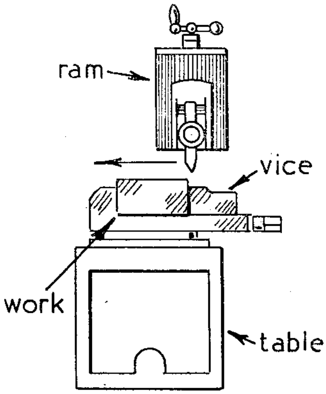


Fig. 6

the crankshaft by means of a connecting-rod from a gear drive. As it is essential that the feed in either direction should be imparted to the tool on its backward stroke, this is provided for in the design of the operating mechanism.

The automatic cross-feed can readily be adjusted to traverse the table from 5 to 25 thousandths of an inch for each stroke of the ram. The rise and fall motion of the table is obtained by moving the cross-slide on the vertical column-slides ; this is effected by means of a square-ended shaft which turns the elevating screw through skew gears.

When the machine is in operation, the cross-slide is securely clamped to the column, and additional support is given to the overhanging end of the table by a footed shaft bearing on the machine's baseplate. Laminated shims are fitted to the column-slides to allow for taking up wear.

The Machine Vice

The base of the vice is fully rotating on its graduated soleplate, which is secured to the table T-slots by four bolts, and is located by means of a detachable tenon fitted into a groove machined in the vice base. The vice, of 4 in. holding capacity and width of jaw, can also be attached to the right-hand side of the table where a groove is provided to accommodate the base tenon. The moving vice jaw is held down by clamp-plates that are adjustable for wear by means of laminated shims. The clamping-screw, which obtains a bearing at either end of the vice body, has a detachable handle and is provided with an adjustable thrust bearing at its farther end.

With this form of construction, the movable jaw is prevented lifting when the clamping pressure is applied.

Guards

Belt guards are fitted on either side of the machine ; that on the right is retained in place by a spring latch, and swings outwards for changing the belt to alter the drive ratio.

A small guard is also fitted over the gear wheels operating the automatic feed mechanism, and it is noticeable that, although this guard is secured in place by two screws, it is also located by two register pins.

Electric Wiring

An on-and-off switch is fitted at the side of the machine, and the switch wiring is carried in a flexible metal conduit to the connector box attached to the motor.

Lubrication

Provision is made for the adequate lubrication of all essential working parts, and in the chart supplied with the machine, no less than thirty-five lubrication points are indicated. Nevertheless, lubrication is simplified as far as possible by fitting roller-bearings and Oilite bronze bushes.

A large inspection cover, retained in place by a spring latch, is fitted to the left-hand side of the column casting to give access for lubricating the crank mechanism. Spring-loaded nipples are fitted to many of the lubrication points, and these are fed by means of a pressure oil-gun supplied with the machine.

In addition, felt pads are fitted to the slides, both to maintain a continuous supply of oil and to prevent the ingress of swarf.

Control

The motor should be switched on with the control lever depressed, so that when the lever is raised the belts take up the drive.

To stop the machine, the lever is again pulled

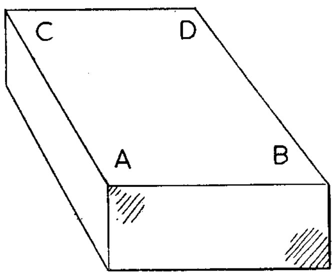


Fig. 7

back and the brake gear coming into action prevents further rotation of the countershaft.

Instruction Book

In the twenty-six page spare parts booklet issued with the machine, full instructions are given for operating, adjusting and lubricating the machine. In addition, the makers have published a folder illustrating the manner of carrying out a wide range of shaping operations.

Testing the Machine

The machine when bolted to the bench ran quietly and without vibration.

The parallelism of the table surface with the

ram-slides was tested, as shown in Fig. 1, by clamping the dial test indicator to the ram-head and moving the ram with a 6-in. stroke.

Next, the alignment of the table traverse for a distance of 6 in. was tested in accordance with Fig. 2. A check on the latter test was made, as illustrated in Fig. 3, by mounting the test indicator on the base of the surface gauge and taking a reading at either end of the cross-slide.

All the above tests revealed a very high standard of accuracy, that is to say in no instance did any detectable variation of the readings exceed a quarter of a thousandth of an inch.

The accuracy of the machine vice was estimated by repeating tests 1 and 2 with the test indicator in contact with the work surface of the vice, as shown in Fig. 4 *A* and *B*; again, no inaccuracy was detected.

Fig 5 illustrates the method used to test the parallelism of the side surfaces of the table with the ram-slides. On the left-hand side of the table no inaccuracy was detected with a ram stroke of 6 in., but on the right-hand side, an error of parallelism of one thousandth of an inch was recorded; this, in some circumstances, might have to be taken into account when setting up work in this position.

As illustrated in Fig. 6 the machine was next tested under working conditions with a piece of mild-steel 3 in. long and 1 in. wide clamped in the machine vice. Although the area of the work was comparatively small, no errors of parallelism, exceeding a quarter of a thousandth of an inch, were detected on taking micrometer measurements at points corresponding with those represented by *A*, *B*, *C* and *D* in Fig. 7. Moreover, a fine finish, almost free from tool marks, was imparted to the work.

The machine is of robust construction and its comprehensive design gives some indication of its worth as a machine tool. The workmanship, the quality of the general finish and the attention to detail all appear to be of a high order. The accuracy of the machine has been amply demonstrated, and the design of the bearings and slides, together with the adequate lubrication system provided, should ensure a long working life. In short, as far as can be judged, this shaping machine should form a valuable addition to the workshop equipment.

PRACTICAL LETTERS

Cylinder Steam Passages

DEAR SIR,—Lest any non-technical reader should assume that all "qualified" steam engineers, as inferred in the last paragraph of K. N. Harris's article in THE MODEL ENGINEER of November 10th, agree wholeheartedly with his views, I wish to put on record that I, for one, do not.

We small locomotive builders, for the most part, desire only a satisfactory performance from our engines on the track. Whatever theoretical arguments may be forthcoming, we rely on experience—"the proof of the pudding," truly, "is in the eating." Some years ago, I built my first small locomotive, an "Annie Boddie." Remembering the 200 years of theory that had been drummed into me at various technical lectures, I felt sure that I knew better than "L.B.S.C." I milled out the steam passages to the same width as the ports with a 2.5 mm. end-mill I happened to possess. The track performance of this engine was most disappointing. It did not run smoothly, and was a "glutton" with fuel and water. Since other builders of this engine had expressed satisfaction with their engines, I thought I would follow the drawings to the letter, so I blocked up the passageways and then drilled them out to instructions. No other alterations were made to the engine, at this stage. The result was quite amazing; gone was the roughness in running, whilst the fuel and water consumption dropped very considerably. "Experience is a hard teacher, but the diploma is worth having."

There is another gentleman whose living—for the past 25 years or so—has largely depended on his ability to produce "designs" for successful small locomotives. I refer, of course, to "L.B.S.C." What a huge number of satisfied customers he has! I sometimes contemplate the situation that would have arisen if he had been a "qualified" steam engineer. Presumably, his critics through the years would then have produced the necessary figures to prove how right he was in his arguments. I feel sure that they wouldn't have let one of "the boys" down.

Ought we not to consider seriously what we are doing before we cross swords with one who has built, or caused to be built, not one, but hundreds of successful small steam locomotives, many of them by people whose daily occupation is far removed from engineering? Mr. Harris's use of the superlative when referring to various small steam locomotives may be justified, but that is a matter of personal opinion.

During my apprenticeship, before the last war, at a locomotive works, I spent many hours chipping and burning out carbon from the cylinder steam passages on the locomotives that were in for "shopping." I can assure Mr. Harris that those passageways were so full of carbon that their cross-sectional area was much less than the area of the steam ports. If those conditions still exist, there are many full-sized locomotives running today with neither "designed size" *nor* streamlined steam passageways.

"Unusual" though "L.B.S.C.'s" ideas may be, they do give excellent results in practice. Furthermore, in conversation and in these columns, many qualified engineers have expressed satisfaction with the results obtained by following his signposts. So the argument does not seem to be so one-sided after all!

Yours faithfully,

Kenilworth. N. SCROUTHER.

Traction Engine Flywheels

DEAR SIR,—An article under the initials "B.C.J." always gives pleasure, and that published in your issue of November 10th, runs true to form, with its display of knowledge and philosophy, seasoned with quiet humour and good sense.

However, I feel sure that our friend will not mind my drawing attention to a paragraph which might unintentionally lead astray would-be builders of traction and portable engines. I know he would not wish to do that, but beginners especially might be misled.

In the first place, his diagram ignores the camber or crowning of the flywheel rim, which was a feature of this class of wheel owing to its being used for belt driving.

Secondly, the *inside* of the rim was also more or less cambered in the reverse direction, partly for aesthetic reasons, but chiefly to allow the pattern to be drawn easily from the moulding sand (see Fig. 1).

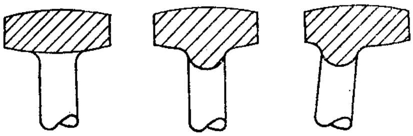


FIG 1 FIG 2 FIG 3

Moreover, it must not be assumed that *all* traction or portable engines lacked the central rib on the inside of the rim, though when used it was usually of a more rounded shape than in B.C.J.'s Fig. 7 (see my Fig. 2). For example, both Paxman's and Ransome's engines had the internal rib, though in the latter it was offset to bring the rim closer in to the hornplate. For the same reason the spokes were "dished" on this make—I refer now to traction-engines only, of course (Fig. 3).

I do agree with B.C.J. that many model traction-engine flywheels are not all they should be, in fact, too frequently this applies to the whole model! I think that quite often it is because the latter is *not* built from a definite prototype; the remedy is obvious, and in the future there will not be any excuse for this.

Yours faithfully,

Sheffield. W. J. HUGHES.

A Vertical Boiler Roller

DEAR SIR,—The type of steam roller illustrated in the November 24th issue was made, I believe, by Aveling & Porter. It was used primarily for bitumen surfacing work, its special feature being its rapid reversibility, very necessary with this kind of surfacing to prevent the rollers sinking in, as they would do if allowed to "dwell." From memory the steering was by handwheel and direct acting worm-gear with most of them, but some at least, had a very interesting form of power-operated steering embodying a little 3-cylinder single-acting radial engine. Such an engine would make a very interesting and unusual model.

Yours faithfully,

Wealdstone. K. N. HARRIS.

Modern Locomotive Design

DEAR SIR,—Surely however much you disapprove of Mr. Bulleid's work he cannot deserve that letter of praise from K. N. Harris. How utterly is Bulleid condemned by K.N.H. writing of him, "he has set out to improve thermal efficiency." Will not Eire think again of employing the man who has helped to lift the steam locomotive from a century-deep rut, in the opinion of one "whose original statements have been accepted amongst steam engineers the world over for 100 years or more," after she has examined these statements?

K.N.H. (June 30th and November 17th) rejoices in high Mean Effective Pressure achieved by cavernous steam passages and compares a 9 per cent. dead space with 4-5 per cent. without noticing that the first holds twice as much steam as the second. Unduly high M.E.P. can be accepted as an *expedient* but never as efficient. The efficiency of any heat engine is the percentage of the heat supplied in its fuel which is converted into work (for a good power station 30 per cent., for a locomotive 8 per cent.). It may be expedient to disregard efficiency in order to get great power from small cylinders by using voluminous steam ways; but it is hypocrisy to worry about normal valve events in such cases. Completely non-expansive working with steam rushing into the cylinder for as much of the stroke as possible will raise the M.E.P. as near to boiler pressure as ingenuity in designing the valve-gear will permit. The power of the engine will soar, and if the boiler can supply the steam, the designer of powerful small commercial engines may feel really complacent in reaching the lowest possible efficiency without going to the trouble of, say, watercooling the cylinder. (Ridiculous? By omitting to lag the ends and flanges of their cylinders they already go in for air cooling! Great-grandpa's engines required such frequent dismantling that this was expedient and "for a 100 years and more" etc. Other thermodynamically abominable practices are similarly perpetuated.)

For his critic, I have much respect and the descriptions of the dream locomotives of the future were delightful. Even these giants will never attain adequate efficiency, and I would rather predict a system of back-pressure power stations stripping power from very high-pressure steam and passing out lower-pressure steam for industrial use and district heating. The station efficiency would be 75 per cent., and with 80 per cent. efficiency in the distribution and electric locomotive, an overall thermal efficiency of 60 per cent. results. That means one ton of coal doing the work which now takes seven tons, and the steam locomotive being built only in the home workshops of the faithful.

A final word; Dr. Fletcher's calculation of feed-pump sizes may be simplified by using the local library's steam tables which will give the volume of 1 lb. of steam at any pressure. Incidentally, normal temperature is 0 deg. C., and the method of calculation although adequate for its purpose, assumes no superheat and is strictly true only for non-expansive working,

Yours faithfully,

Warrington. W. H. NIGHTINGALE.

International Racing

DEAR SIR,—I read with great interest the letters from M. Mitchell in the November 10th issue, and from M. Clark in the November 17th issue, which reveals as a major criticism the fact that M. Stone uses American engines.

It would certainly be desirable to organise meetings (international or not) with home-made engines, but I think this proposition hopeless, as very few of our actual model engineers are able to design their own engines and certainly even less have the workshop facilities to build them.

This proof was clearly shown during the Geneva and Paris regattas: out of 12 entries, only 3 were home-made engines, 2 were stock commercial French engines, and 7 were American. If we had restricted the entries only to the home-made engines, there would have been only *one* competitor in the 10 c.c. class; let me ask what would have happened in such a mono-competition regatta?

As builder of my own engines and not suspected of favouritism, let me conclude that I was very glad on these occasions to meet 12 excellent racing boats, no matter where the engines came from, and my best wish is to see such a good international meeting next season as we had this year on the Continent.

About the discussion against American engines: it is really a pity that so many clever model engineers are afraid of these commercial engines, when model engineers worthy of international class are certainly capable of building an equivalent power plant, if not a better one.

About the organisation itself and the suitability of the pond, I am not entirely in agreement with M. Mitchell; of course, the straight-running course attracts the greatest number of competitors, but I can hardly imagine an international straight-running event. Personally, I feel unable to organise such a competition on account of the varieties in the types of models (yacht, liner, tug-boat, cargo, torpedo-boat, etc.) there would be so many entries that there would not be enough hours in the day.

In that case, any international steering competition would probably be easier to organise, then the difficulty would be the carrying of these heavy representative vessels overseas.

Nothing is impossible, but my opinion is that, speed being the aristocracy of the sport, the only way for our international sport remains the circular-course, and the Geneva regatta showed us that with a good organisation, the interest of the spectators can be held throughout the day *exclusively* with racing boats.

Neither am I in agreement with M. Clark; the Victoria Park pond is better than nothing, but it is certainly not the best pond for speed, as I can say from personal experience in the past years. In 1948, I had to slow down my boat *Mdlle Sylla* considerably to complete the 5 laps before capsizing. The excuse that "the pond is the same for all" is true, but let me say that it is a pity to slow down an engine (even American ones) to avoid the risk of capsizing, as by such policy, all competitors will be showing us a slow-speed event instead of a high-speed one (and funnily enough, the winning position will probably appear more difficult to reach).

Therefore, we must know what is wanted for international competition: speed or not?

At le Vesinet, as I have already mentioned in my report (THE MODEL ENGINEER, November 17th, page 628), we had difficulties in the choice of the suitable area of the pond for high speed; in fact, the first part of the regatta with the 30-c.c. boats was very bad and these ran at a disadvantage, but after this experiment we were obliged to find a better spot on the pond, which we eventually did for the afternoon race. The only difference with the high speed obtained in Geneva was the atmospheric conditions.

I think that everything should be done to facilitate the highest speed.

I must say again that it is very discouraging to build a really fast boat without having any chance to show her speed on the day of an international race, it is paying too dear for a lot of work and the result of such a policy will appear easily.

On this subject I don't understand why for race cars, one is so careful to establish a perfectly flat racing track instead of a rough one. The problem is exactly the same, with a rough one, only heavy cars with extra spring suspension will have the chance to gain; in that case also speed will be out of the question.

Yours faithfully,
Paris. G. M. SUZOR.

Model Marine Power Units

DEAR SIR,—On reading the paragraph under "Smoke Rings" on model marine power units in your November 17th issue, I feel bound to voice my feelings.

Regarding the fitting out of the machinery in a prototype model, this entails much more work than the same job in a speed boat hull. This, I fear, deters most people, as there is a limited space to work in and a fixed position for funnel, deckhouse, engine room, etc.; also, after having spent months in completing a hull with all fittings, etc., one feels a little browned off.

The speed boat counterpart calls for less work, both in hull and deckgear, and does not require to represent, in the majority of cases, any prototype vessel.

No facilities are arranged for prototype competitions up north, the shipshape model having to compete against combinations of hulls and engines which should never be called ships.

This position seems to be the reason for the gradual disappearance of the prototype vessel because some people take competition winning seriously and do not care to be almost another also-ran year after year.

My view is that if we are to retain the prototype vessel at all, with its shabby engine room the clubs should revise their competition rules and encourage the construction of this class of vessel, which at least is a pleasure to see.

Yours faithfully,
West Hartlepool. J. F. TAYLOR.